IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NEW YORK

SPECTRONICS CORPORATION,

Plaintiff,

v.

PERCEPTRON, INC.

Defendant.

Case No. CV 12 - 434

BIANCO, J.

COMPLAINT AND JURY DEMAND

SUMMONS ISSUED

Plaintiff Spectronics Corporation (hereinafter "Spectronics") alleges as follows:

Parties

1. Spectronics is a New York corporation having its principal place of business at 956 Brush Hollow Road, Westbury, New York 11590.

2. On information and belief, defendant Perceptron, Inc. ("Perceptron") is a corporation having its principal place of business at 47827 Halyard Drive, Plymouth, MI 48170. Perceptron sells products throughout the country, and does business in the Eastern District of New York and is subject to the jurisdiction of this Court.

3. Spectronics is the assignee of the entire right, title and interest in United States Letters Patent No. 6,491,408 ("the '408 patent") titled "Pen-Size Inspection Lamp for Detection of Fluorescent Material," which issued on December 10, 2002. A copy of the '408 patent is attached hereto as Exhibit A. The '408 patent covers a UV inspection lamp that has a flexible/extendible section for positioning a UV or blue LED lamp during fluorescent leak detection.

4. Spectronics is also the assignee of the entire right, title and interest in United States Letters Patent No. 6,854,859 (the '859 patent") titled "Pen Size LED Inspection Lamp for Detection of Fluorescent Material," which issued on February 15, 2005. A copy of the '859 patent is attached hereto as Exhibit B. The '859 patent is directed to an inspection device with an adjustable reflective mirror for leak detection.

5. On information and belief, Perceptron has been and continues to sell private label products sold under Snap-On Tools Company's brand name. One product is marketed as the Video Inspection Device, model number BK5500 which includes an LED head at the end of a flexible extension and a handheld base unit. A second product is marketed as the Video/Still Recording Digital Borescope, model number BK6000 and which also includes an LED head at the end of a flexible extension and a handheld base unit. Both products are provided in a kit that includes a mirror which is attachable to the LED head. *See* Exhibit C. Snap-On provides an accessory for both products called the Blue Light/UV Imager Head (model BK5500-10) which is designed to attach to the BK6000 and BK5500 base units for providing UV/Blue LED light. The foregoing products are referred to collectively as the "Accused Products." Perceptron markets the Accused Products on its website as the VideoScope Device and the Wireless VideoScope. *See* Exhibit D. According to the materials published by Perceptron, the Blue Light/UV Imager Head can be used with the Accused Products for leak detection in air conditioning units in vehicles. *See* Exhibit E.

6. On information and belief, Perceptron has been and continues to market and sell the Accused Products throughout the country through its customer, Snap-On Tools Company, and has sold and continues to sell into the Eastern District of New York.

Jurisdiction and Venue

7. This is a complaint for infringement of a United States patent under 35 U.S.C. §§ 271 and 281.

8. Jurisdiction arises under 28 U.S.C. §§ 1331 and 1338.

9. Venue in this district is proper under 28 U.S.C. §§ 1391(b) and (c).

COUNT I

PATENT INFRINGEMENT OF US PATENT 6,491,408

10. The '408 patent grants Spectronics the right to prevent others from making, having made, using, importing, advertising, selling and offering for sale particular inspection lamp products for use in detecting fluorescent materials which leak out of an air conditioning system which are covered by the claims in that patent. Claims 6-15 relate to an embodiment of the lamp that includes a handle having a flexible portion and a lower portion. A lamp housing is mounted to the end of the flexible portion and includes at least one LED which emits light within a wavelength of below about 500 nm. This wavelength range is important inasmuch as LED light wavelengths below about 500 nm generate fluorescence of perylene-based and naphthalimide-based fluorescent compounds which may be leaking from an air conditioning system.

11. On information and belief, Perceptron has directly infringed the '408 patent by making, having made, using, selling and/or offering for sale the Accused Products which are covered by at least claims 6-8, 14 and 16 of the '408 patent.

12. On information and belief, Perceptron has known of the '408 patent and has willfully continued to infringe the patent.

13. Perceptron's infringement of the '408 patent has deprived, and will deprive, Spectronics of sales which it otherwise would have made.

COUNT II

PATENT INFRINGEMENT OF US PATENT 6,854,859

14. The '859 patent grants Spectronics the right to prevent others from making, having made, using, importing, advertising, selling and offering for sale particular inspection lamp products for use in detecting fluorescent materials which leak out of an air conditioning system which are covered by the claims in that patent.

15. Claims 6-15 relate to an embodiment of the lamp that includes a handle having a flexible portion and a lower portion. A lamp housing is mounted to the end of the flexible portion and includes at least one LED which emits light within a wavelength of below about 500 nm. This wavelength range is important inasmuch as LED light wavelengths below about 500 nm generate fluorescence of perylene-based and naphthalimide-based fluorescent compounds which may be leaking from an air conditioning system.

16. On information and belief, Perceptron has directly infringed the '859 patent by making, having made, using, selling and/or offering for sale the Accused Products which are covered by at least claims 6-8, 11 and 12 of the '859 patent.

17. On information and belief, Perceptron has known of the '859 patent and has willfully continued to infringe the patent.

18. Perceptron's infringement of the '859 patent has deprived, and will deprive, Spectronics of sales which it otherwise would have made.

PRAYERS FOR RELIEF

WHEREFORE, Spectronics Corporation demands judgment against Perceptron, and demands relief as follows:

A. That this Court preliminarily and permanently enjoin Perceptron, and those officers, directors, agents, employees and any person or entity in active concert or participation with any of them from infringing the '408 patent;

B. That this Court preliminarily and permanently enjoin Perceptron, and those officers, directors, agents, employees and any person or entity in active concert or participation with any of them from infringing the '859 patent;

C. That Perceptron be ordered to deliver up for destruction all infringing inspection lamps in their possession or under their control;

D. That this Court award Spectronics money damages under 35 U.S.C. § 284 sufficient to compensate Spectronics for the financial damage caused by Perceptron's infringement, including enhanced damages if the infringement is found to be willful, and its reasonable attorney fees under 35 U.S.C. § 285; and

E. That this Court award to Spectronics such other and further relief as is authorized by statute or is deemed appropriate by this Court.

JURY DEMAND

Spectronics Corporation hereby demands a trial before a jury on all counts contained in its Complaint.

Respectfully submitted,

DRINKER BIDDLE & REATH LLP

Dated: January 31, 2012

BY: 

THUY T. BUI
Drinker Biddle & Reath LLP
1177 Avenue of the Americas, 41st Floor
New York, NY 10036-2714
(212) 248-3144
(212) 248-3141 fax
Thuy.Bui@dbr.com

ROBERT E. CANNUSCIO
(pro hac vice admission pending)
Drinker Biddle & Reath LLP
One Logan Square, Suite 2000
Philadelphia, PA 19103-6996
Tel: (215) 988-3303
Fax: (215) 988-2757
Robert.Cannuscio@dbr.com
Attorneys for Plaintiff
SPECTRONICS CORPORATION

Exhibit A

US006491408B1

(12) **United States Patent**
Cooper et al.

(10) **Patent No.: US 6,491,408 B1**
(45) **Date of Patent: Dec. 10, 2002**

(54) **PEN-SIZE LED INSPECTION LAMP FOR DETECTION OF FLUORESCENT MATERIAL**

(75) Inventors: **B. William Cooper**, Lloyd Harbor, NY (US); **Gustavo Garcia**, Lake Grove, NY (US)

(73) Assignee: **Spectronics Corporation**, Westbury, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/899,796**

(22) Filed: **Jul. 5, 2001**

(51) **Int. Cl.**[7] **F21V 33/00**
(52) **U.S. Cl.** ..... **362/184**; 362/198; 362/230; 362/800; 250/504 H
(58) **Field of Search** ..... 362/184, 186, 362/198, 138, 230, 293, 118, 119, 800; 250/504 H

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,788,364	A *	8/1998	Cooper et al.	250/504 H
5,975,712	A *	11/1999	Shiao	362/198
6,200,134	B1 *	3/2001	Kovac et al.	362/800

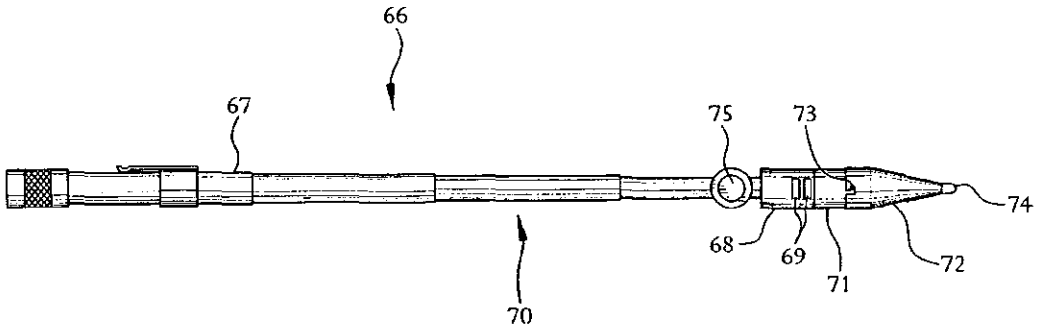
* cited by examiner

Primary Examiner—Stephen Husar
(74) *Attorney, Agent, or Firm*—Drinker Biddle & Reath LLP

(57) **ABSTRACT**

A pen-size inspection lamp for detecting fluorescent materials. The inspection lamp includes a lamp housing, an extendible handle, and at least one LED.

29 Claims, 8 Drawing Sheets



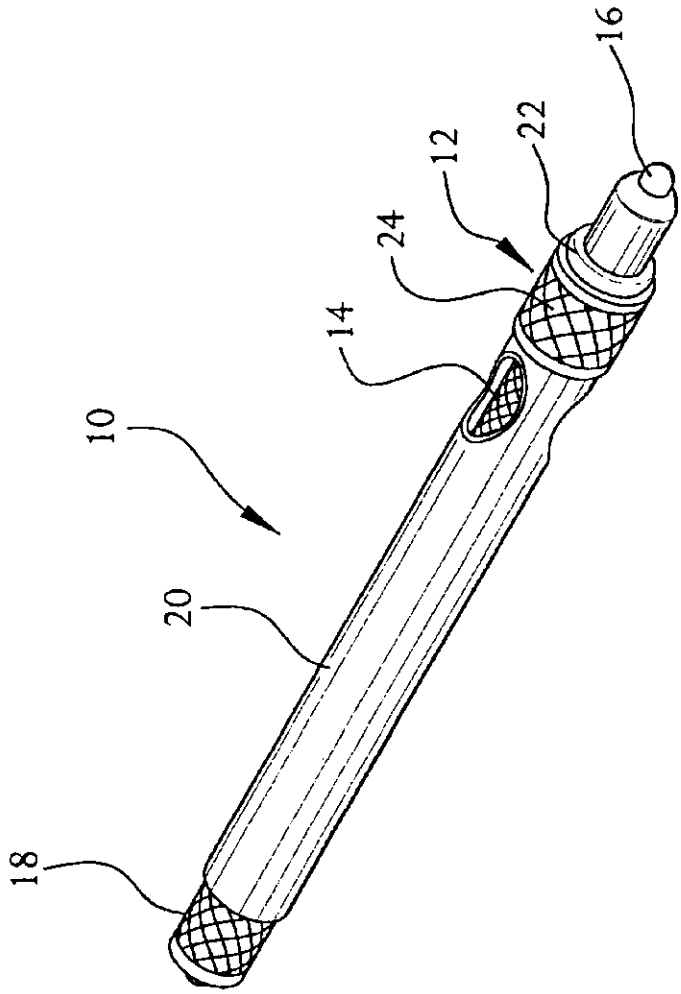


FIG. 1

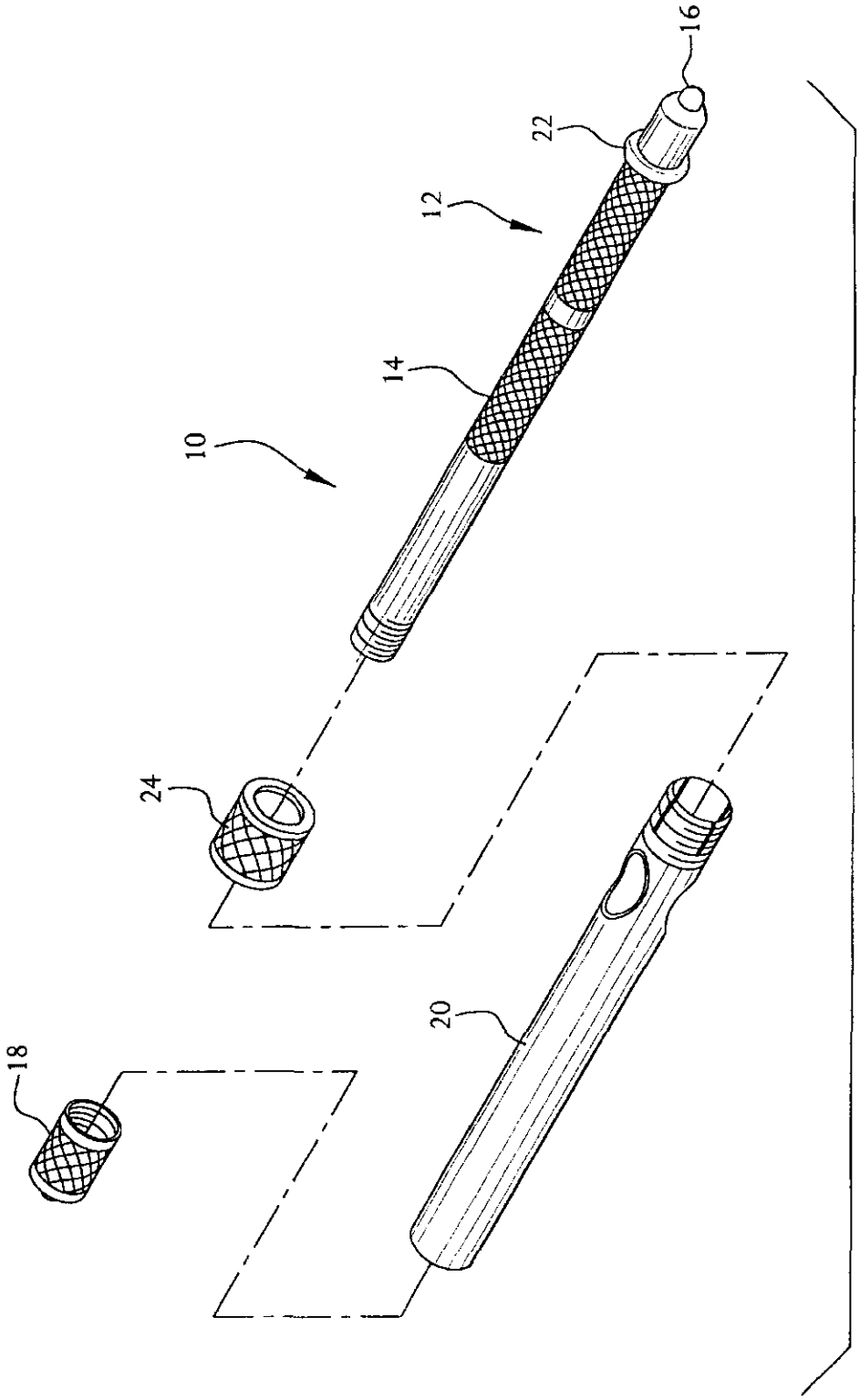


FIG. 2

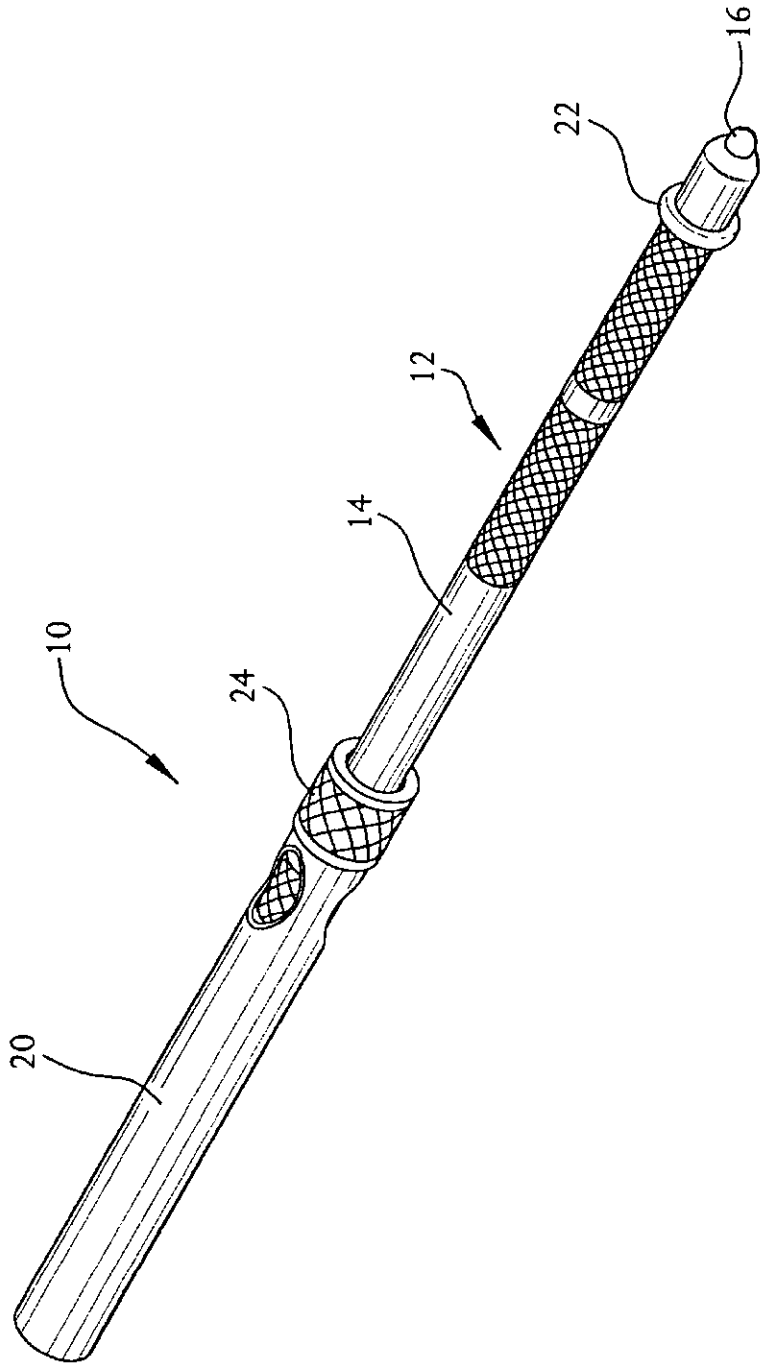


FIG. 3

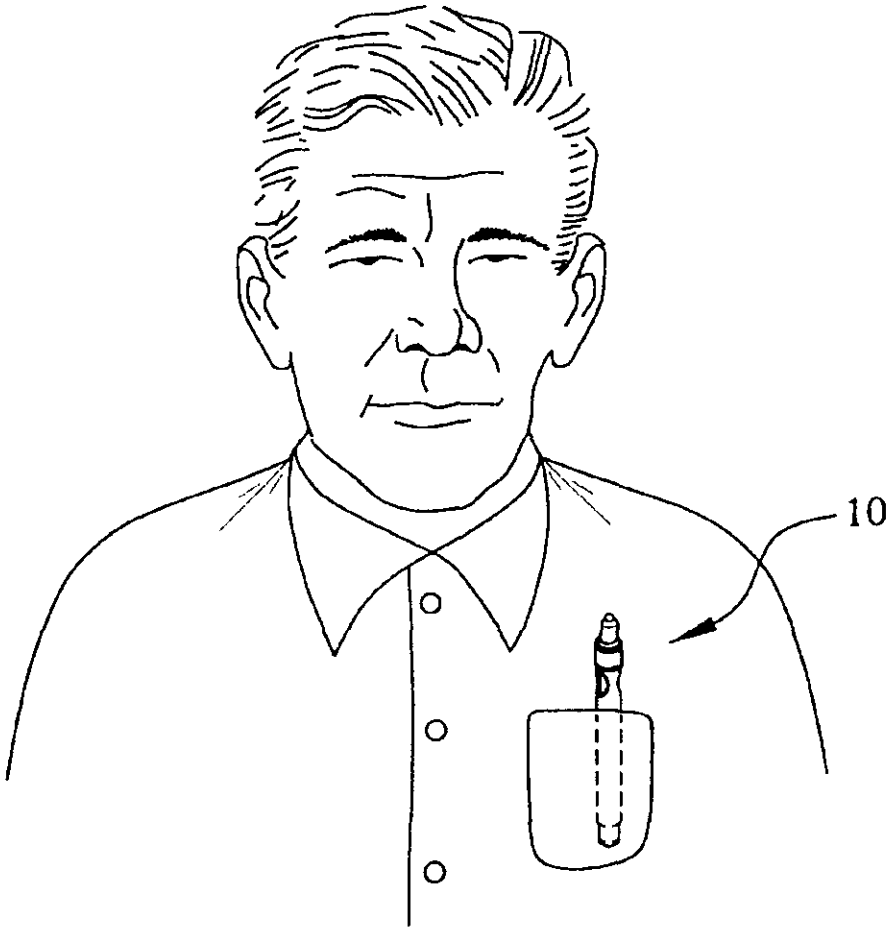


FIG. 4

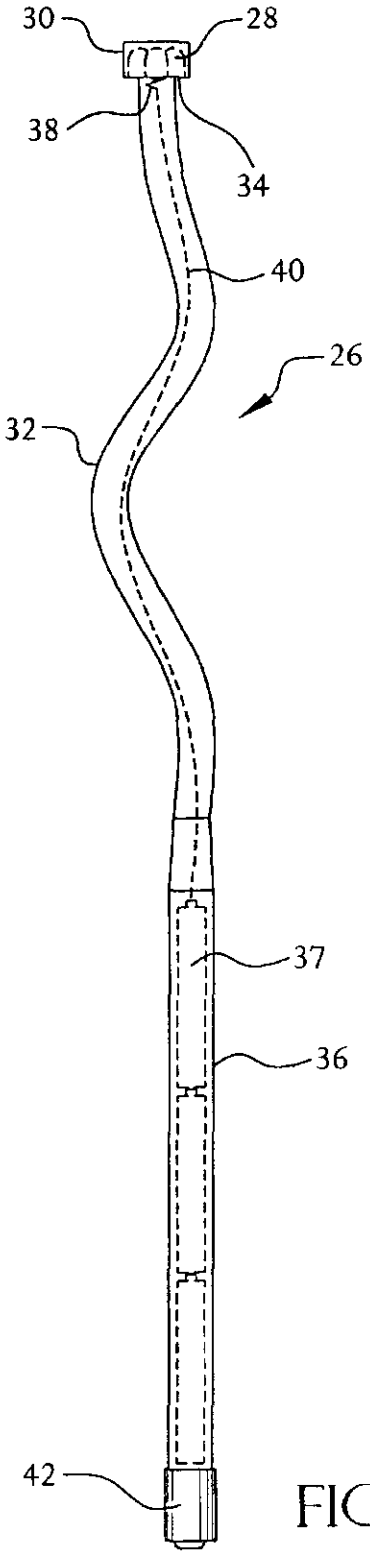


FIG. 5A

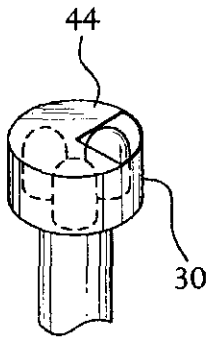


FIG. 5B

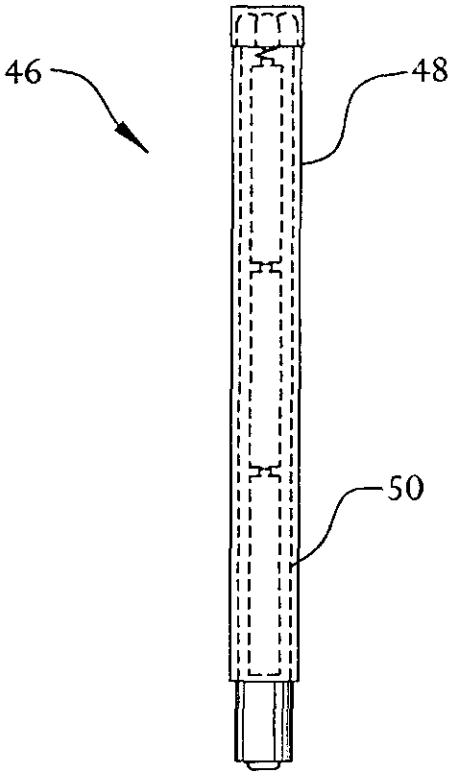


FIG. 6A

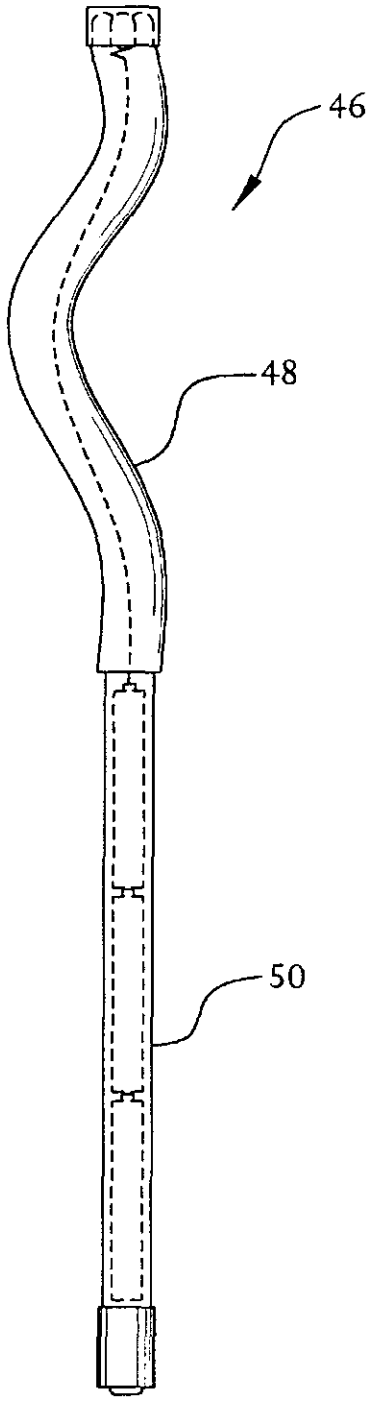


FIG. 6B

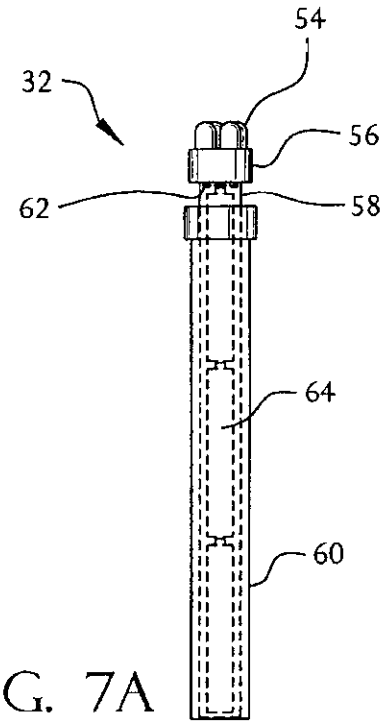


FIG. 7A

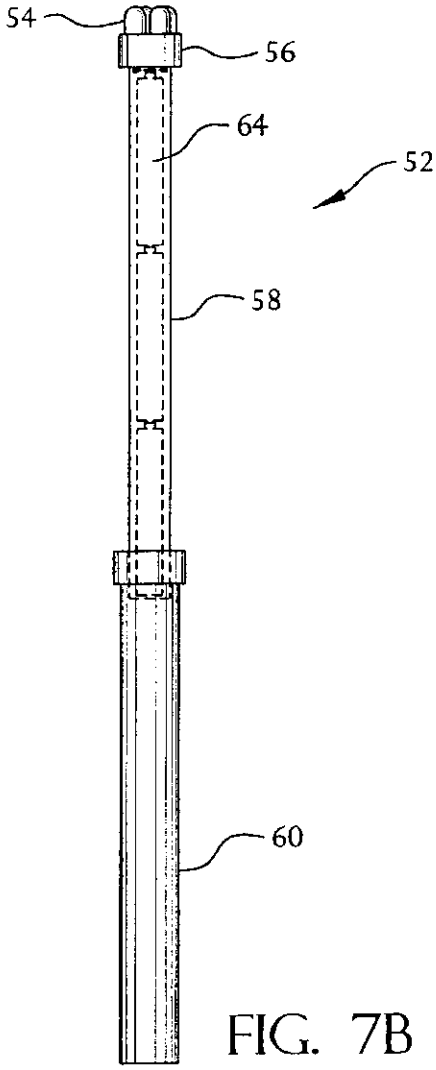


FIG. 7B

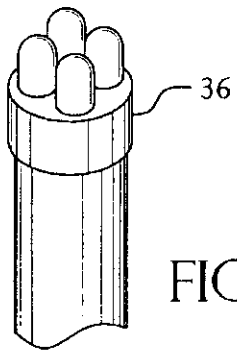


FIG. 7C

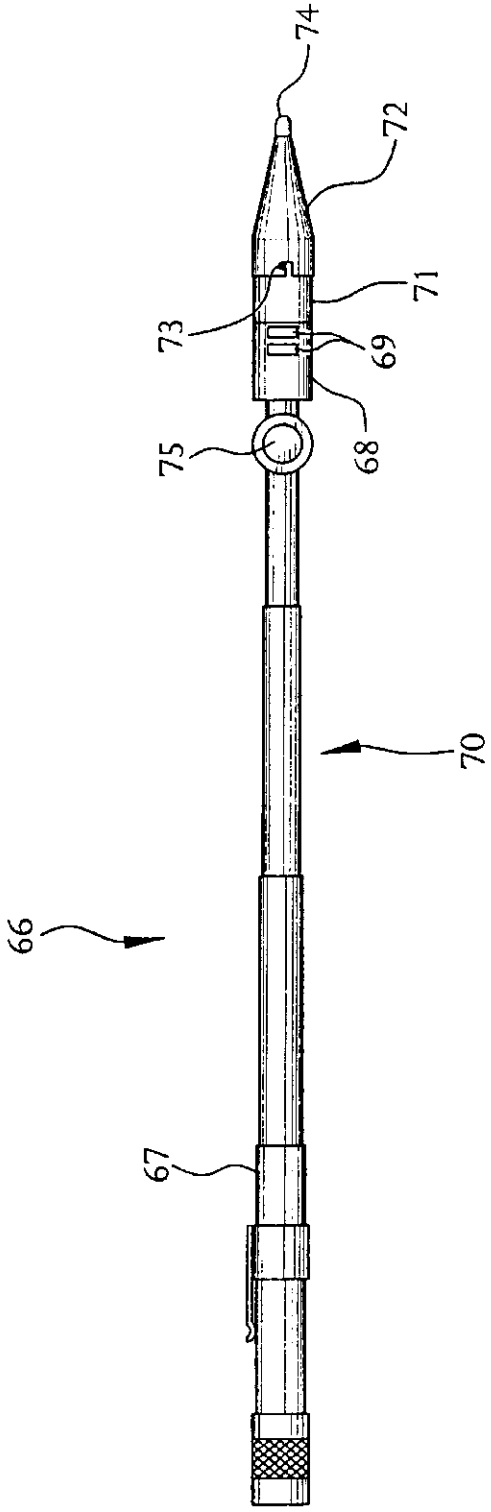


FIG. 8

PEN-SIZE LED INSPECTION LAMP FOR DETECTION OF FLUORESCENT MATERIAL

FIELD OF THE INVENTION

The invention relates to the general field of inspection lamps utilized for detection of fluorescent materials.

BACKGROUND OF THE INVENTION

Leak detection and surface flaw non-destructive testing techniques often use fluorescent dye additives or fluorescent penetrants. These techniques rely upon the unique physical property of various materials to fluoresce when excited by certain wavelengths of light.

Fluorescence is generally understood to be a property that enables some materials to absorb light energy and to radiate visible light at a longer wavelength than the absorbed light. According to generally accepted theory, electrons in fluorescent materials are excited upon being illuminated by light energy of a specific absorption band wavelength, and emit light energy in a longer wavelength response band as the electrons return to the unexcited or ground state. The specific excitation and response wavelengths are characteristics of the particular fluorescent materials.

The apparent brightness of a fluorescent material's luminescence is dependent on the wavelength and the intensity of the incident radiation. The excitation band generally has one or more peak wavelengths that will produce a greater response than incident light of the same intensity at an off-peak wavelength. Thus, a fluorescent material which has an excitation peak at a specific wavelength may exhibit a much reduced luminescence as the wavelength of incident light deviates from the excitation peak, and will lose the ability to fluoresce when the incident light does not provide enough energy within the excitation range.

For example, two commonly used fluorescent leak detection dyes are perylene-based fluorescent compounds and naphthalimide-based fluorescent compounds. Perylene dyes produce a yellow fluorescent response when exposed to incident radiation which includes the UV-A wavelength band of about 315 nm to about 400 nm, with a strong peak between about 340 to 375 nm. Naphthalimide dyes fluoresce green when exposed to incident radiation of visible violet/blue light in a range from about 400 nm to about 480 nm.

A fluorescent response is more visible when the intensity of other visible light is reduced, so that the fluorescent response is not masked or washed-out by other light. The various UV-A or Violet/Blue inspection lamps use several types of light sources and filtering to produce a light output in the excitation bands with little or no output light in the fluorescent response band. For example, a lamp having a high intensity incandescent light source with a narrow band UV (360–370 nm) absorption filter will emit light energy concentrated around the excitation peak of a perylene dye additive. An inspection lamp with a wider band UV/BLUE absorption filter centered at about 400 nm provides output in the UVA and visible violet/blue range, with the greatest intensity centered in the excitation band of a common naphthalimide dye compound. In the absorption filter lamps, however, the larger portion of light energy in the visible and infrared wavelengths is absorbed as heat in the filter.

A more efficient inspection lamp uses thin-film dichroic reflectance filter. A dichroic filter can be tailored to reflect back into the lamp only the range of visible wavelengths outside of the chosen excitation band, while passing the other wavelengths. Because the emitted light is not converted to heat in the dichroic filter, the lamp can be made considerably more compact than the lamps with absorption filters.

All of the above-described prior lamps use a broad spectrum light source, and thus require some type of filtering, whether absorption or dichroic, to transmit light in an excitation band while restricting light output in the visible fluorescent response band. In the present invention, however, the inspection lamp uses the narrow band electroluminescence of solid state lamps, specifically light-emitting diodes (hereinafter referred to as "LEDs") with glass envelopes that refract light to the tip of the envelope. LEDs have been known for many years, but until recent developments it has been difficult to obtain sufficiently high levels of luminous flux as would be required for an inspection lamp. This problem was particularly acute for LEDs emitting in the blue to UV bands, which produced much less lumens per watt than the red, yellow and green emitting LEDs. [See, Lighting Handbook, 8th edition, Illuminating Engineers Society of North America, Chapter 6, figure 6.68(f)].

Recent developments in nitride semiconductor materials, particularly gallium nitride (GaN) based epitaxal structures, have provided more efficient LEDs that can produce sufficient lumens for an inspection lamp in the UV 360–390 nm range. For example, a GaN electroluminescent device as described in U.S. Pat. No. 5,898,185 has an emission peak at 380 nm. An LED emitting in the 360 nm–390 nm range would make a useful light source for detection of a perylene dye.

GaN alloys can produce other useful emission bands. The same patent describes a commercial GaInAlN LED that emits blue light at 460 nm. The light emission wavelengths of GaN LEDs can also be altered by phosphor films if desired. As described in the specification of the U.S. Pat. No. 5,898,185 patent, these GaN-based LEDs have high efficiencies, typically in the energy emitted/power-in range of 10%.

The invention uses these LED light sources in the form of a LED bulb in which the glass lens capsule directs light to the rounded tip of the capsule. This causes a narrow high intensity focus at the tip and a diverging beam emanating from the tip. The effect is having a highest light intensity at the capsule tip and a rapidly decreasing intensity as distance from the tip increases. Thus, while the intensity at close distances may be sufficient to excite a strong response from a fluorescent dye, the intensity at longer distances may not be enough to produce the fluorescent response.

An LED inspection lamp can be very small, in fact, it can be the size of a pen light powered by AAAA sized batteries. A current LED pen light, the STYLUSTM model with an "Ice Blue" emitting LED is only 0.38 inches in diameter and 6.60 inches in length and operates on three AAAA batteries with a run time of over 10 hours, yet it has sufficient blue light output to cause a fluorescent response in a naphthalimide-based leak detection additive from a distance of 18 inches in dark conditions. Even in daylight conditions, it can excite a naphthalimide dye to a bright response at one to six inches.

Although the narrow shape of the LED pen light is helpful in allowing the LED capsule to be inserted into narrow areas close to a suspected leak site, it is still restricted by its length. Furthermore, the metal handle and battery housing is inflexible. Both the short length and inflexibility can make it difficult or impossible to reach areas of potential leak sites,

such as lines and connectors in the circuit of an automobile air conditioner.

It would therefore be useful to provide an LED lamp that has a high intensity focus at the tip as well as an extendible handle so that the lamp may be inserted deeply into tight areas to bring the tip of the LED capsule close to the potential leak site to be investigated for fluorescent material. An extendible handle may alternatively be flexible to aid in insertion around obstructions. An alternative embodiment lamp may have two or more different color LEDs, such as violet and blue, which may be selectively used to detect more than one type of fluorescent material, or may have an LED and a white light bulb to select between general illumination and fluorescent detection.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided an inspection lamp for detecting fluorescent materials. The inspection lamp includes a housing, an extendible handle and at least one LED.

BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of illustrating the invention, there is shown in the drawings a form which is currently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. **1** is an exploded isometric view of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **2** is an isometric view of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **3** is an isometric view of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **4** is an illustration of a human being with an embodiment of the inspection lamp in his shirt pocket.

FIG. **5**A is a side elevation view of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **5**B is an isometric view of the lamp housing of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **6**A is a side elevation view of an embodiment of the inspection lamp where the lamp is in the unextended position in accordance with the present invention.

FIG. **6**B is a side elevation view of an embodiment of the inspection lamp where the lamp is extended in accordance with the present invention.

FIG. **7**A is a side elevation view of an embodiment of the inspection lamp where the lamp is in the unextended position in accordance with the present invention.

FIG. **7**B is a side elevation view of an embodiment of the inspection lamp where the lamp is extended in accordance with the present invention.

FIG. **7**C is an isometric view of the lamp housing of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **8** is a isometric view of an embodiment of the inspection lamp where the inspection lamp includes a telescoping handle.

DESCRIPTION OF THE INVENTION

FIGS. **1**–**4** show an embodiment of an inspection lamp **10** in accordance with the invention. This embodiment of inspection lamp **10** includes an LED pen light **12** having an aluminum housing **14**. In this embodiment, shown in FIG. **2**, a rear end of the housing is threaded while the front end includes an aperture for receiving a glass lens capsule **16**. The housing **14** is adapted to enclose the LED pen light's batteries, switch contacts and light source. The pen light **12** uses a blue LED as its light source. The glass lens capsule **16** of the LED extends out through the front end of the housing. An example of a suitable commercially available LED pen light of this type is the STYLUS3 "ICE BLUE" penlight by Streamlight®.

The bottom of the pen light housing **14** has a screw cap **18** that also serves as an ON/OFF switch by pressing the batteries into an electrical connection, either by tightening the screw cap or by pressing a momentary switch at the back of the cap.

A hollow extendible handle **20** is adapted to slidingly engage around the housing **14** of the LED pen light. The top end of the extendible handle is adapted to receive a locking mechanism **24** for locking the handle in a desired position relative to the housing, in effect extending the handle of the inspection lamp **10** to a desired length. In this embodiment, the top end of the handle is threaded and slotted, while the locking mechanism is a threaded collar. When the collar **24** is tightened to the bottom of the threads, it compresses the slotted tip of the handle and presses it against the pen light housing to keep the pen light from sliding within the handle. A stop ring **22** is provided around the pen light housing to prevent the collar from slipping off the front end of the pen light.

In FIG. **1**, the inspection lamp is shown locked in a fully retracted position. FIG. **3** shows the same lamp locked in a fully extended position. FIG. **4** shows the inspection lamp carried as a pen light inside a shirt pocket so as to illustrate the lamp's relative size.

The light from the LED is directed through the rounded tip of the glass lens capsule. Thus, the emitted light beam has its highest light intensity in a narrow beam at the tip of the glass capsule **16**, and the beam diverges as distance from the tip increases.

In FIGS. **5**A and **5**B, an alternative embodiment inspection lamp **26** uses three LEDs **28** inside a lamp housing **30**. The lamp housing **30** is attached to an extendible handle **26** having an upper flexible portion **32** and a lower rigid portion **36** of the inspection lamp. The upper flexible portion **32** includes a hollow cavity and can be adjusted and extended as desired. The upper flexible portion **32** can be folded onto the lower rigid portion **36** to shorten the length of the inspection lamp.

The underside of the lamp housing **34** includes electrical contacts **38** to connect the LEDs **28** to a conductor wire **40**. The wire **40** extends downward from the electrical contact **38** through the upper flexible portion **32** to connect with the batteries **37**. The lower rigid portion **36** includes a removable cap **42**. The removable cap **42** includes a metallic coil for completing the circuit in the typical fashion to power the LEDs **28**.

FIG. **5**B shows a closer view of the lamp housing **30**. The top side of the lamp housing includes a rotatable cover **44** with an aperture suitable for only one LED for selectively blocking the light from two of the LEDs, so that only the light from one LED is emitted from the inspection lamp at any one time. The lamp housing **30** may contain different LEDs **28** and may also include an incandescent lamp or other suitable source of white light.

For example, the lamp may contain three LEDs, one in each of ultraviolet, blue, and green. Depending on the

fluorescent dye being used, the cover can be rotated so that only the appropriate LED is emitted by the inspection lamp. For instance, if a perylene-based fluorescent compound is being used, the ultraviolet LED may be selected. When using a naphthalimide-based fluorescent compound, the blue LED may be selected.

Shown in FIGS. **6A** and **6B** is another embodiment where the pen-size inspection lamp has an extendible handle **46** which is at least part flexible. An upper flexible portion **48** is slidably engaged with the lower rigid portion **50**. The upper flexible portion **48** has an inner diameter greater than the outer diameter of the lower rigid portion **50**. FIG. **6A** shows the inspection lamp in a non-flexed and non-extended position. FIG. **6B** shows the inspection lamp fully extended and partially flexed.

FIGS. **7A**, **7B**, and **7C** show another embodiment of the present invention, in which the inspection lamp has four LEDs **54** attached to a lamp housing **56**. An incandescent lamp or other source of white light may substituted for one of the LEDs. The lamp housing is rotatably attached to an upper portion **58** of an extendible handle **52**. The extendible handle **52** comprises the upper portion **58** and a lower portion **60**. The upper portion **58** is slidably engaged with the lower portion **60**. The outer diameter of the upper portion **58** is less than the inner diameter of the lower portion **60**. The upper portion **58** and lower portion **60** include a hollow cavity as shown in FIGS. **7A** and **7B**. In a preferred embodiment, the hollow cavity of the upper portion **58** contains a power source. In the same embodiment, the power source is an internal power source comprising at least one battery **64**.

The underside of the lamp housing **56** includes a plurality of electrical contacts **62**. The number of electrical contacts **62** located at the underside of the lamp housing **56** corresponds to the number of LEDs and sources of white light **54** attached to the lamp housing **56**. As noted earlier, when working with leak detection dyes, certain LEDs work most efficiently in conjunction with certain fluorescent compounds. In one embodiment, three LEDs, ultraviolet, blue, and green, and one source of white light are attached to the lamp housing. In order to selectively illuminate a single LED or source of white light, the lamp housing **56** is rotated so as to cause the electrical contact of the desired LED or white light to contact the inspection lamp's source of power. For instance, if the green LED is to be emitted by the inspection lamp, the lamp housing **56** is rotated so as to cause the green LED's electrical contact to connect with the power source.

The embodiment of the present invention shown in FIGS. **7A** and **7B** may be extended to illuminate hard-to-reach areas. FIG. **7B** shows the inspection lamp fully extended.

Referring now to FIG. **8**, another embodiment of the present invention is shown in which the inspection lamp **66** includes an extendible handle **67** and a removable LED lamp assembly **72**. In this embodiment, the extendible handle **67** is comprised of a plurality of slidingly engaged cylinders **70** of sequentially reduced diameter to facilitate the handle's ability to extend and contract in a telescoping manner. The telescoping handle **67** may be comprised of any number of cylinders and those cylinders may be of any size or shape. For instance, the circular section cylinders may be replaced with hollow square cylinders. In FIG. **8**, the handle is shown in an extended position.

In one embodiment of the inspection lamp **66** shown in FIG. **8**, there is a battery housing **68** opposite the telescoping handle **67**. The battery housing **68** may include controls **69** for connecting the LED lamp assembly **72** to at least one battery and to have a threaded top (not shown) for releasably engaging a screw cap **71**. The battery housing **68** is configured to accept coinsized batteries (not shown) to provide electrical power to the LED lamp assembly **72**. The LED lamp assembly **72** is releasably attached to the screw cap **71**. In the depicted embodiment, the LED lamp assembly **72** may be locked in place with a locking mechanism, an example of which is shown in FIG. **8**, numeral **73**. The locking device **73** shown in FIG. **8** is simply shown as an example; those skilled in the art will realize that many arrangements capable of releasably locking the LED lamp assembly **72** to the screw cap **71** could be used.

In a preferred embodiment, the LED lamp assembly **72** includes an LED **74** with a wavelength band having a peak intensity below about 500 nm. It is important to note however, that the LED lamp assemblies **72** are interchangeable, and thus the lamp **66** may be configured with an LED having any wavelength band. Therefore, if it is desirable to utilize an LED of a particular color, the user may simply replace the LED lamp assembly **72** with an LED lamp assembly **72** having the color of choice. For instance, a user using the inspection lamp **66** with a LED lamp assembly **72** having a blue LED may find it desirable to use a LED lamp assembly **72** having a green LED. If so, the user may simply remove the LED lamp assembly **72** having a blue LED and replace it with a LED lamp assembly **72** having a green LED.

In other embodiments, where the LED lamp assembly **72** may include two or more LEDs, it is preferable if at least one LED has a wavelength band with a peak intensity below about 500 nm. In such an embodiment, the controls **69** are adapted to selectively illuminate at least one LED, as desired.

In a preferred embodiment, there is a hinge **75** located between the handle **70** and the housing **68**, as shown in FIG. **8**. In other embodiments, where a hinge is not present, housing **68** is simply attached to the telescoping handle **70**.

It is important to note that the various forms of extendible handles as well as the manner in which the various embodiments are able to emit a single LED or white light and are able to extend and flex is completely interchangeable. For example, the lamp housing **30** and cover **44** used for selectively emitting a single LED as shown in FIGS. **5A** and **5B** may be utilized with the upper **58** and lower **60** cylindrical portions shown in FIGS. **7A** and **7B**.

In other embodiments, aspects of the handle may include alternative means for extending the inspection lamp from a shorter configuration to a longer configuration. Such means may include, for example, a spring and release mechanism for causing the inspection lamp to quickly extend by activating the release of a spring-type mechanism or other device capable of causing the inspection lamp to quickly extend. A means for extending the inspection lamp may also be configured similar in operation to a typical jack knife that is folded in half and locked when not in use. Such a configuration could include a hinge, ball-joint or other suitable element for causing the lamp to be collapsed approximately in half. A configuration could also include a locking mechanism so that the lamp is locked into place when collapsed or folded, as well as a release mechanism for releasing the lock. The release could be employed with or without a spring-type mechanism.

The present invention may also be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be

made to the appended claims, rather than to the foregoing specification, as indicating the scope of the invention.

What is claimed is:

1. An inspection lamp for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent materials added to the refrigerant and lubricating oil, said inspection lamp comprising an LED pen light having a housing enclosing a power source and an LED, the housing having a rear end and a front end, with a glass lens capsule at the front end, said inspection lamp further comprising;

a hollow handle adapted to receive the pen light, whereby the pen light may be retracted into the handle or extended out of the handle; and

wherein the LED emits light within a wavelength band below about 500 nm.

2. An inspection lamp as in claim 1, wherein the LED emits light within a wavelength band between about 315 nm and about 400 nm.

3. An inspection lamp as in claim 1, wherein the LED emits light within a wavelength band between about 400 nm and about 480 nm .

4. An inspection lamp as in claim 1, wherein the LED emits light within a wavelength band between about 360 nm and about 380 nm.

5. An inspection lamp as in claim 1, wherein the handle is slidably engaged within the housing and has a threaded top portion adapted to receive a locking mechanism for locking the pen light at a desired extension out of the handle.

6. An inspection lamp for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent materials added to the refrigerant and lubricating oil, said inspection lamp comprising:

a lamp housing;

at least one LED located within the lamp housing and emitting light within a wavelength band below about 500 nm;

a handle having an upper flexible portion attached to the lamp housing and a lower portion;

wherein the flexible portion may be bent to fit into hard-to-reach areas of the air-conditioning system.

7. An inspection lamp as in claim 6, wherein the flexible portion may be bent so as to shorten the length of the lamp.

8. An inspection lamp as in claim 6, further comprising a plurality of LEDs within the lamp housing.

9. An inspection lamp as in claim 8, wherein the plurality of LEDs comprises at least one LED emitting light within a wavelength band between about 315 nm to about 400 nm.

10. An inspection lamp as in claim 8, wherein the plurality of LEDs comprises at least one LED emitting light within a wavelength band between about 400 nm to about 480 nm.

11. An inspection lamp as in claim 6, further comprising a light-impervious cover for selectively blocking the light emitted from the at least one LED.

12. An inspection lamp as in claim 11, wherein the light-impervious cover rotatably engages with the top of the lamp housing.

13. An inspection lamp as in claim 12, wherein at least a portion of the light-impervious cover is transparent or open.

14. An inspection lamp as in claim 6, further comprising at least one source of white light.

15. An inspection lamp as in claim 14, further comprising a light-impervious cover for selectively blocking the light emitted from the at least one LED and the at least one source of white light, as desired.

16. An inspection lamp for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent materials added to the refrigerant and lubricating oil, said inspection lamp comprising:

a lamp housing;

a plurality of LEDs enclosed within the lamp housing, at least one of which emitting light within a wavelength band below about 500 nm; and

an extendible handle attached to the lamp housing.

17. An inspection lamp as in claim 16, wherein the plurality of LEDs comprises at least one LED emitting light within a wavelength band between about 315 nm to about 400 nm.

18. An inspection lamp as in claim 16, wherein the plurality of LEDs comprises at least one LED emitting light within a wavelength band between about 400 nm to about 480 nm.

19. An inspection lamp as in claim 18, further comprising a plurality of electrical contacts, wherein at least one electrical contact is attached to each LED and the lamp housing is rotatably engaged with the handle such that rotating the lamp housing selects an LED to be connected to a power source and thereby illuminated.

20. An inspection lamp as in claim 19, further comprising at least one source of white light.

21. An inspection lamp as in claim 20, further comprising a plurality of electrical contacts, wherein at least one electrical contact is attached to each LED and to each source of white light, and wherein the lamp housing is rotatably engaged with the handle such that rotating the lamp housing selects an LED or source of white light to be selectively connected to a power source and thereby illuminated.

22. An LED inspection lamp for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent materials added to the refrigerant and lubricating oil, said inspection lamp comprising:

extendable and retractable handle having a grip section and telescoping sections adapted to be pulled out to extend the handle and pushed in to retract the handle,

a battery housing containing a battery, the battery housing being attached at one end thereof to the telescoping section that is furthest from the grip section when the handle is extended; and

an LED lamp assembly connected to the battery housing and containing an LED.

23. An inspection lamp as in claim 22, further comprising the lamp having controls to selectively connect the LED to the battery.

24. An inspection lamp as in claim 23, wherein the lamp assembly contains a plurality of LEDs.

25. An inspection lamp as in claim 24, further comprising the lamp having controls to selectively connect an LED to the battery.

26. An inspection lamp as in claim 22, wherein the LED emits light within a wavelength band between about 315 nm to about 400 nm.

27. An inspection lamp as in claim 22, wherein the LED emits light within a wavelength band between 400 nm to about 480 nm.

28. An inspection lamp as in claim 22, wherein the LED lamp assembly is removable and a first LED lamp assembly having an LED emitting light within a first wavelength band is interchangeable with a second LED lamp assembly having an LED emitting light within a different wavelength band.

29. An inspection lamp as in claim 22, further comprising a hinge located between the grip end of the handle and the LED lamp assembly.

* * * * *

Exhibit B

US006854859B2

(12) **United States Patent**
Cooper et al.

(10) **Patent No.: US 6,854,859 B2**
(45) **Date of Patent: *Feb. 15, 2005**

(54) **PEN SIZE LED INSPECTION LAMP FOR DETECTING FLUORESCENT MATERIAL**

(75) Inventors: **B. William Cooper**, Lloyd Harbor, NY (US); **Gustavo Garcia**, Lake Grove, NY (US)

(73) Assignee: **Spectronics Corporation**, Westbury, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/215,629**

(22) Filed: **Aug. 9, 2002**

(65) **Prior Publication Data**

US 2003/0007345 A1 Jan. 9, 2003

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/899,796, filed on Jul. 5, 2001, now Pat. No. 6,491,408.

(51) **Int. Cl.**[7] **F21V 33/00**

(52) **U.S. Cl.** **362/139**; 362/184; 362/198; 362/230; 362/800

(58) **Field of Search** ..... 362/184, 186, 362/198, 138, 230, 293, 118, 119, 800, 139; 250/504 H

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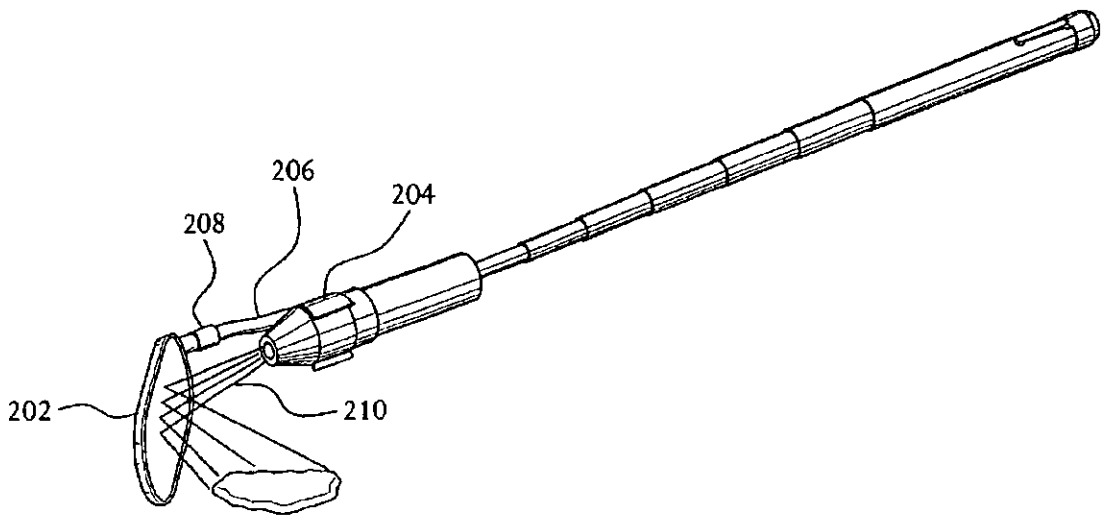
Primary Examiner—Stephen Husar
Assistant Examiner—Sharon Payne
(74) *Attorney, Agent, or Firm*—Drinker Biddle & Reath LLP

(57) **ABSTRACT**

A pen-size inspection lamp for detecting fluorescent leak detection materials in hard-to-reach areas. The inspection lamp includes a housing, an extendible handle, at least one LED and a mirror assembly. The mirror assembly includes a mirror, a clip for attaching the mirror to the housing, and an arm extending between the clip and the mirror with a hinge connection for rotating the mirror to different reflection angles with respect to the LED.

23 Claims, 9 Drawing Sheets



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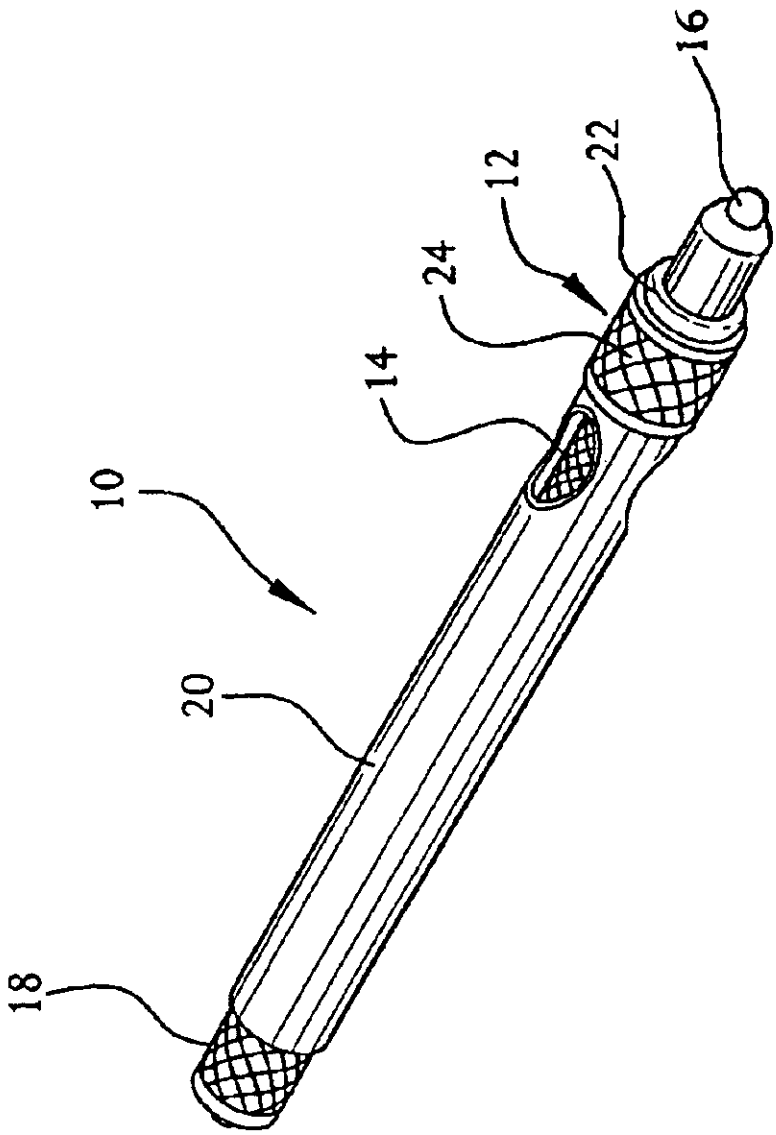


FIG. 1

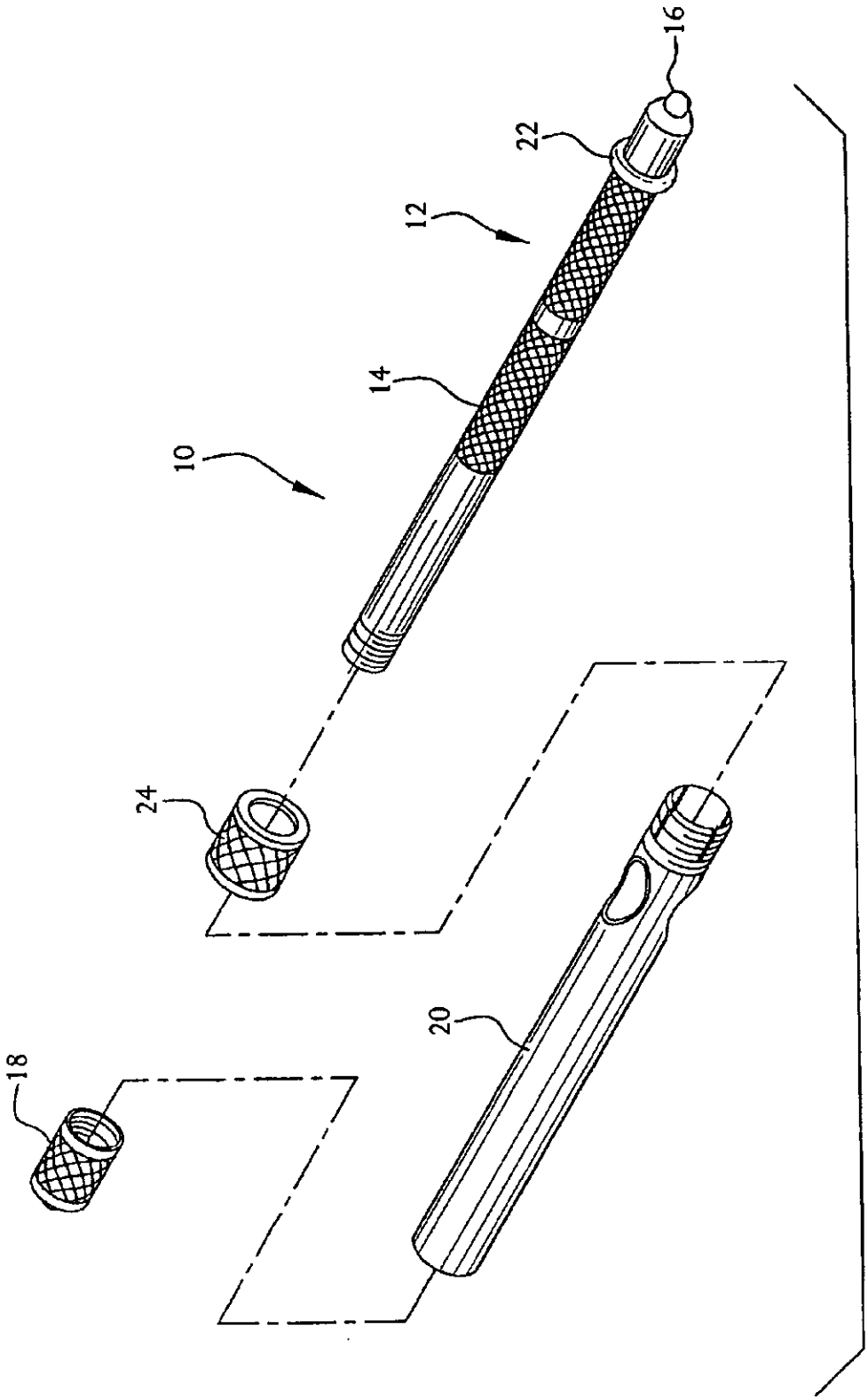


FIG. 2

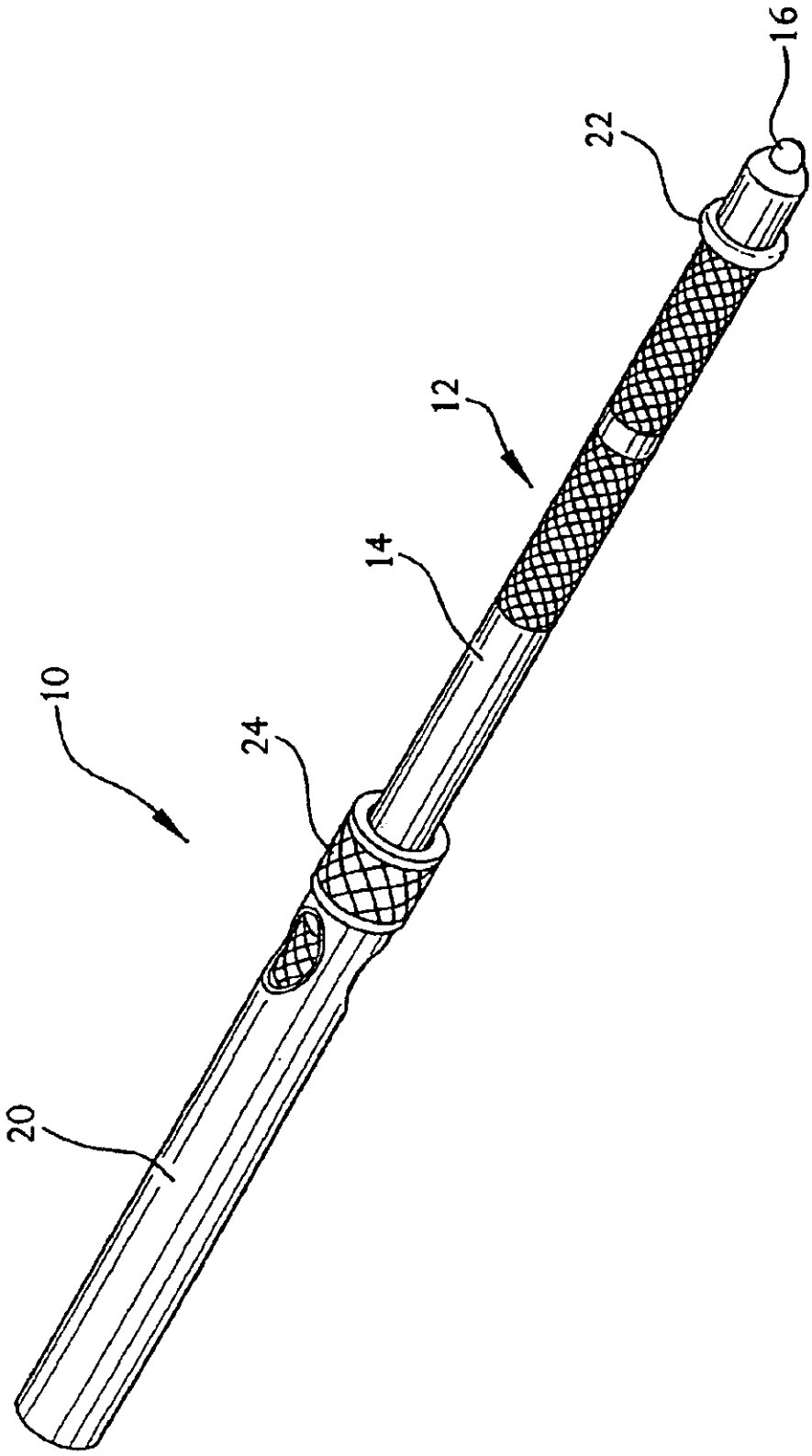


FIG. 3

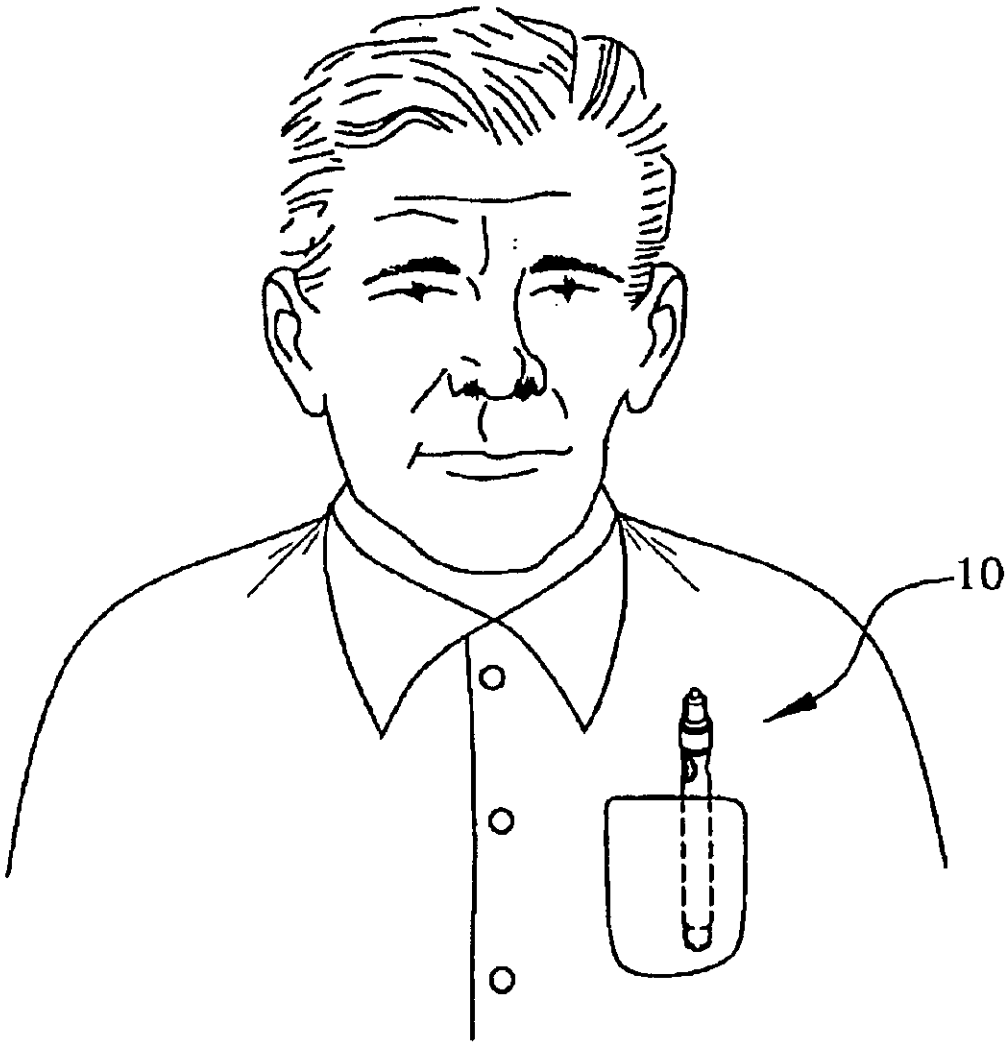


FIG. 4

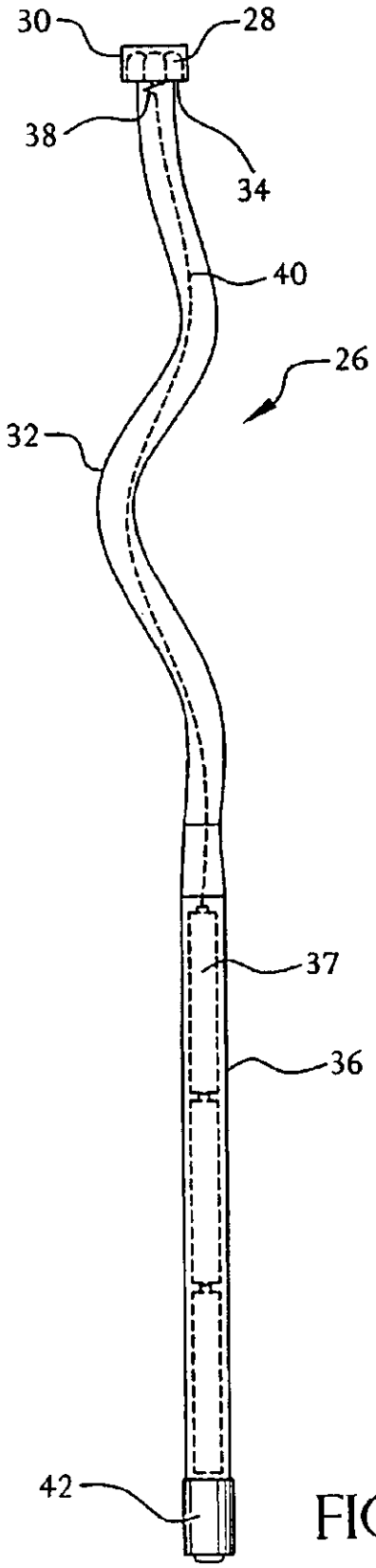


FIG. 5A

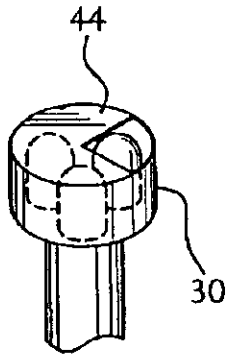


FIG. 5B

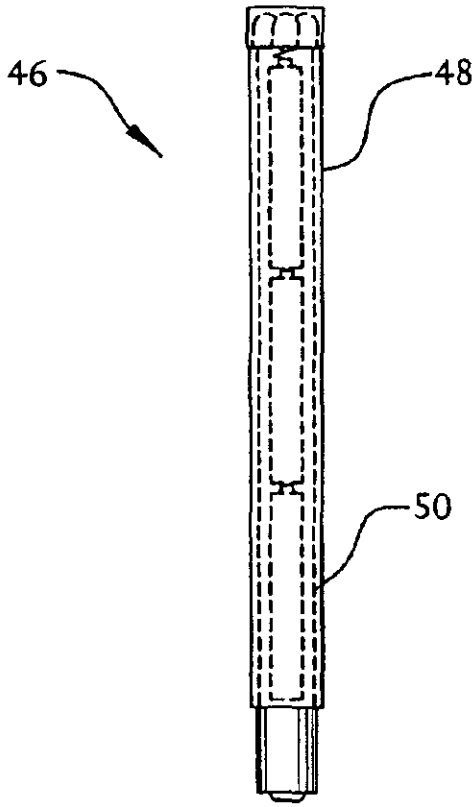


FIG. 6A

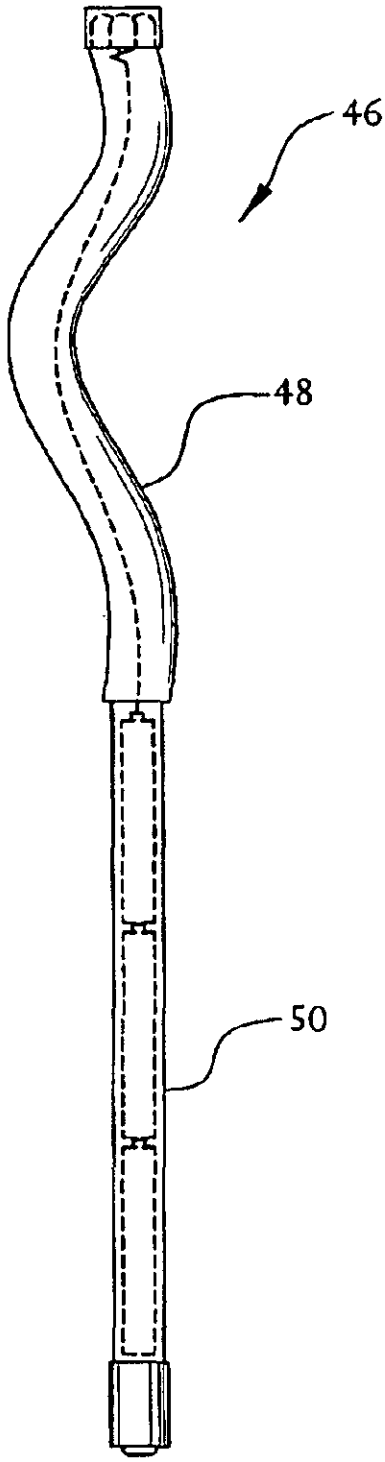


FIG. 6B

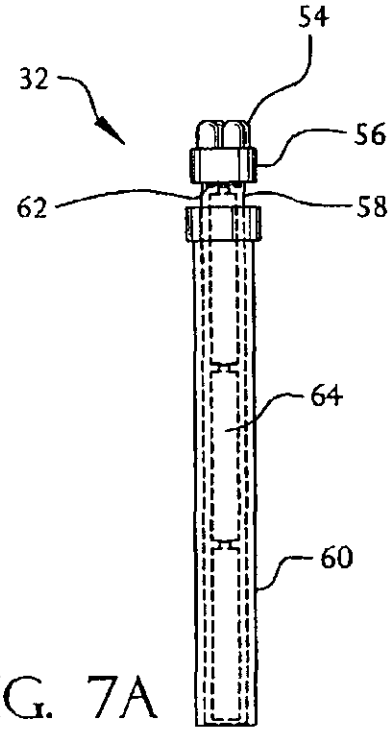


FIG. 7A

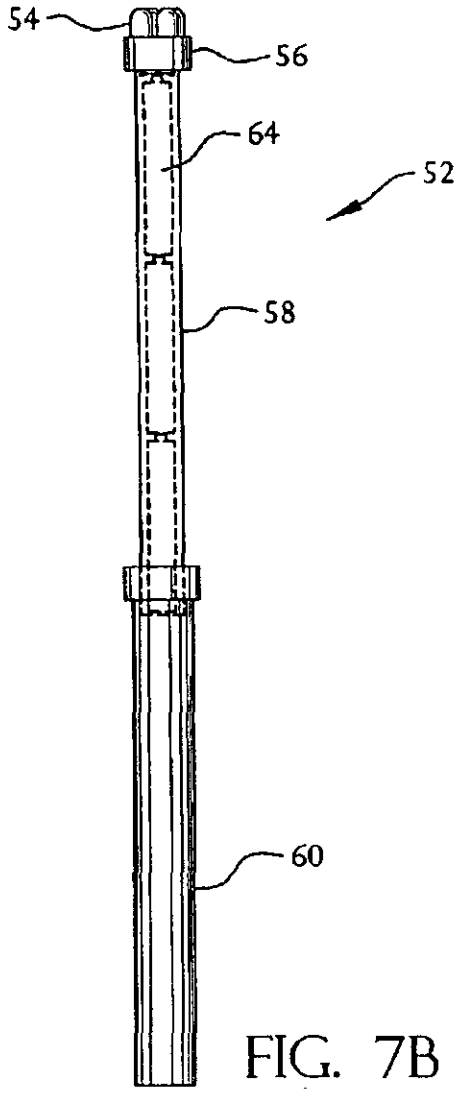


FIG. 7B

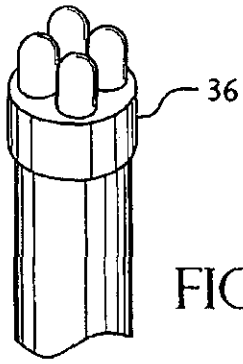


FIG. 7C

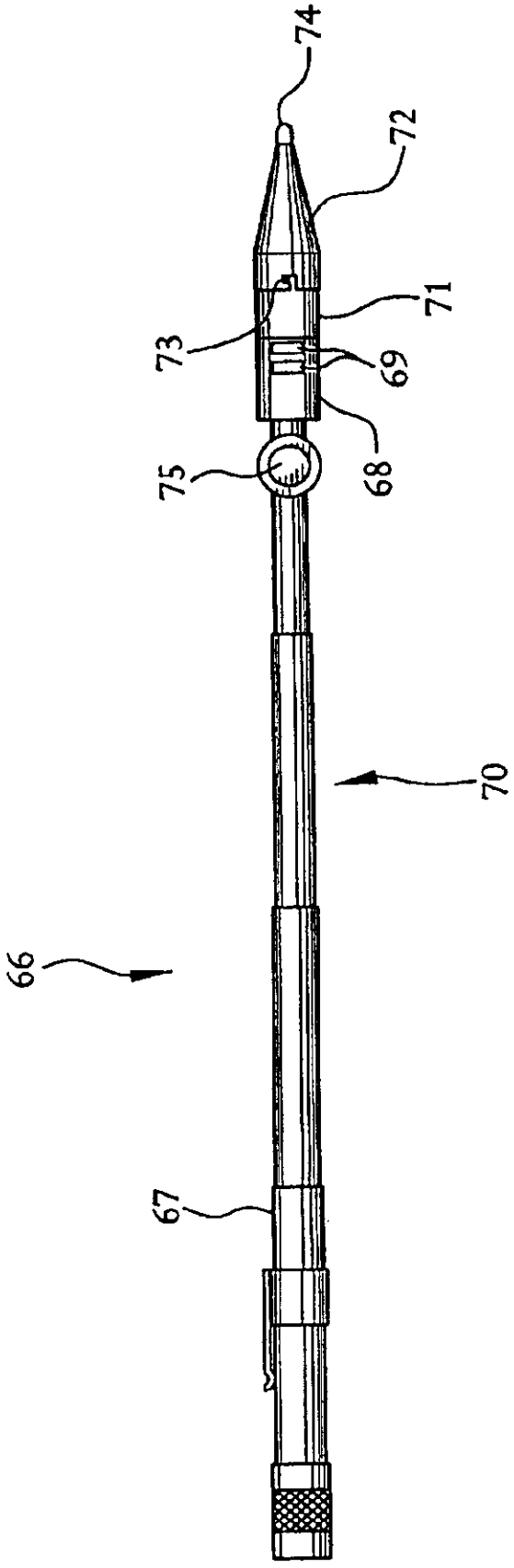


FIG. 8

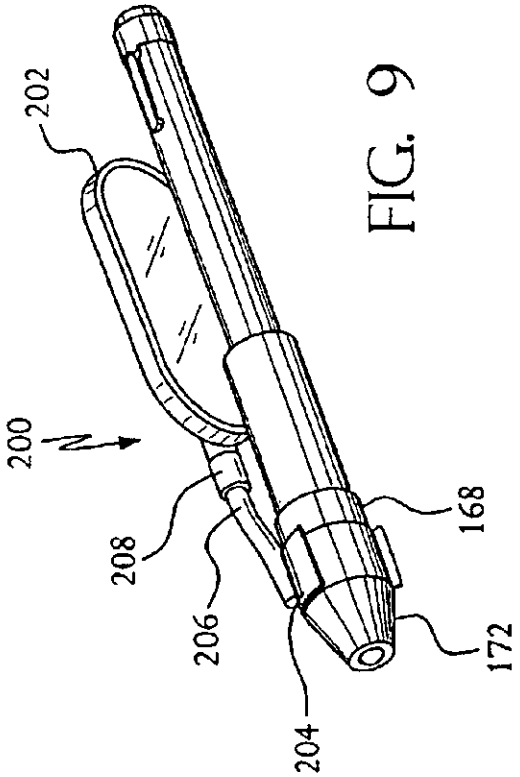


FIG. 9

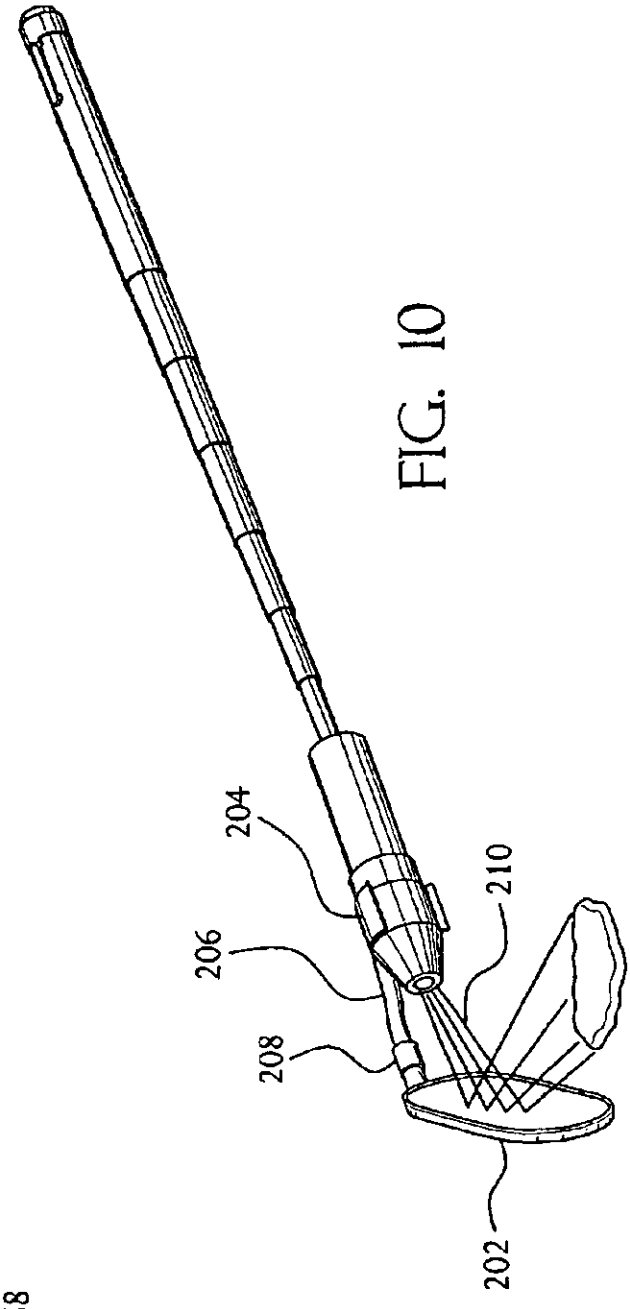


FIG. 10

PEN SIZE LED INSPECTION LAMP FOR DETECTING FLUORESCENT MATERIAL

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. application Ser. No. 09/899,796, filed Jul. 5, 2001 now U.S. Pat. No. 6,491,408.

FIELD OF THE INVENTION

The invention relates to the general field of inspection lamps utilized for detection of fluorescent materials.

BACKGROUND OF THE INVENTION

Leak detection and surface flaw non-destructive testing techniques often use fluorescent dye additives or fluorescent penetrants. These techniques rely upon the unique physical property of various materials to fluoresce when excited by certain wavelengths of light.

Fluorescence is generally understood to be a property that enables some materials to absorb light energy and to radiate visible light at a longer wavelength than the absorbed light. According to generally accepted theory, electrons in fluorescent materials are excited upon being illuminated by light energy of a specific absorption band wavelength, and emit light energy in a longer wavelength response band as the electrons return to the unexcited or ground state. The specific excitation and response wavelengths are characteristics of the particular fluorescent materials.

The apparent brightness of a fluorescent material's luminescence is dependent on the wavelength and the intensity of the incident radiation. The excitation band generally has one or more peak wavelengths that will produce a greater response than incident light of the same intensity at an off-peak wavelength. Thus, a fluorescent material which has an excitation peak at a specific wavelength may exhibit a much reduced luminescence as the wavelength of incident light deviates from the excitation peak, and will lose the ability to fluoresce when the incident light does not provide enough energy within the excitation range.

For example, two commonly used fluorescent leak detection dyes are perylene-based fluorescent compounds and naphthalimide-based fluorescent compounds. Perylene dyes produce a yellow fluorescent response when exposed to incident radiation which includes the UV-A wavelength band of about 315 nm to about 400 nm, with a strong peak between about 340 to 375 nm. Naphthalimide dyes fluoresce green when exposed to incident radiation of visible violet/blue light in a range from about 400 nm to about 480 nm.

A fluorescent response is more visible when the intensity of other visible light is reduced, so that the fluorescent response is not masked or washed-out by other light. The various UV-A or Violet/Blue inspection lamps use several types of light sources and filtering to produce a light output in the excitation bands with little or no output light in the fluorescent response band. For example, a lamp having a high intensity incandescent light source with a narrow band UV (360–370 nm) absorption filter will emit light energy concentrated around the excitation peak of a perylene dye additive. An inspection lamp with a wider band UV/BLUE absorption filter centered at about 400 nm provides output in the UVA and visible violet/blue range, with the greatest intensity centered in the excitation band of a common naphthalimide dye compound. In the absorption filter lamps, however, the larger portion of light energy in the visible and infrared wavelengths is absorbed as heat in the filter.

A more efficient inspection lamp uses thin-film dichroic reflectance filter. A dichroic filter can be tailored to reflect back into the lamp only the range of visible wavelengths outside of the chosen excitation band, while passing the other wavelengths. Because the emitted light is not converted to heat in the dichroic filter, the lamp can be made considerably more compact than the lamps with absorption filters.

All of the above-described prior lamps use a broad spectrum light source, and thus require some type of filtering, whether absorption or dichroic, to transmit light in an excitation band while restricting light output in the visible fluorescent response band. In the present invention, however, the inspection lamp uses the narrow band electroluminescence of solid state lamps, specifically light-emitting diodes (hereinafter referred to as "LEDs") with glass envelopes that refract light to the tip of the envelope. LEDs have been known for many years, but until recent developments it has been difficult to obtain sufficiently high levels of luminous flux as would be required for an inspection lamp. This problem was particularly acute for LEDs emitting in the blue to UV bands, which produced much less lumens per watt than the red, yellow and green emitting LEDs. [See, Lighting Handbook, 8th edition, Illuminating Engineers Society of North America, Chapter 6, figure 6.68(f)].

Recent developments in nitride semiconductor materials, particularly gallium nitride (GaN) based epitaxal structures, have provided more efficient LEDs that can produce sufficient lumens for an inspection lamp in the UV 360–390 nm range. For example, a GaN electroluminescent device as described in U.S. Pat. No. 5,898,185 has an emission peak at 380 nm. An LED emitting in the 360 nm–390 nm range would make a useful light source for detection of a perylene dye.

GaN alloys can produce other useful emission bands. The same patent describes a commercial GaInAlN LED that emits blue light at 460 nm. The light emission wavelengths of GaN LEDs can also be altered by phosphor films if desired. As described in the specification of the U.S. Pat. No. 5,898,185, these GaN-based LEDs have high efficiencies, typically in the energy emitted/power-in range of 10%.

The invention uses these LED light sources in the form of a LED bulb in which the glass lens capsule directs light to the rounded tip of the capsule. This causes a narrow high intensity focus at the tip and a diverging beam emanating from the tip. The effect is having a highest light intensity at the capsule tip and a rapidly decreasing intensity as distance from the tip increases. Thus, while the intensity at close distances may be sufficient to excite a strong response from a fluorescent dye, the intensity at longer distances may not be enough to produce the fluorescent response.

An LED inspection lamp can be very small, in fact, it can be the size of a pen light powered by AAAA sized batteries. A current LED pen light, the STYLUS™ model with an "Ice Blue" emitting LED is only 0.38 inches in diameter and 6.60 inches in length and operates on three AAAA batteries with a run time of over 10 hours, yet it has sufficient blue light output to cause a fluorescent response in a naphthalimide-based leak detection additive from a distance of 18 inches in dark conditions. Even in daylight conditions, it can excite a naphthalimide dye to a bright response at one to six inches.

Although the narrow shape of the LED pen light is helpful in allowing the LED capsule to be inserted into narrow areas close to a suspected leak site, it is still restricted by its length. Furthermore, the metal handle and battery housing is inflex-

ible. Both the short length and inflexibility can make it difficult or impossible to reach areas of potential leak sites, such as lines and connectors in the circuit of an automobile air conditioner.

It would therefore be useful to provide an LED lamp that has a high intensity focus at the tip as well as an extendible handle so that the lamp may be inserted deeply into tight areas to bring the tip of the LED capsule close to the potential leak site to be investigated for fluorescent material. An extendible handle may alternatively be flexible to aid in insertion around obstructions. An alternative embodiment lamp may have two or more different color LEDs, such as violet and blue, which may be selectively used to detect more than one type of fluorescent material, or may have an LED and a white light bulb to select between general illumination and fluorescent detection. An LED lamp with an extendible handle may also have a mirror attached to permit inspect under or around an obstruction.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided an inspection lamp for detecting fluorescent materials. The inspection lamp includes a housing, an extendible handle, and at least one LED, and may include a mirror.

BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of illustrating the invention, there is shown in the drawings a form which is currently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. **1** is an isometric view of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **2** is an exploded isometric view of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **3** is an isometric view of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **4** is an illustration of a human being with an embodiment of the inspection lamp in his shirt pocket.

FIG. **5A** is a side elevation view of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **5B** is an isometric view of the lamp housing of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **6A** is a side elevation view of an embodiment of the inspection lamp in which the lamp is in the unextended position in accordance with the present invention.

FIG. **6B** is a side elevation view of an embodiment of the inspection lamp in which the lamp is extended in accordance with the present invention.

FIG. **7A** is a side elevation view of an embodiment of the inspection lamp in which the lamp is in the unextended position in accordance with the present invention.

FIG. **7B** is a side elevation view of an embodiment of the inspection lamp in which the lamp is extended in accordance with the present invention.

FIG. **7C** is an isometric view of the lamp housing of an embodiment of the inspection lamp in accordance with the present invention.

FIG. **8** is an isometric view of an embodiment of the inspection lamp in which the inspection lamp includes a telescoping handle.

FIG. **9** is an isometric view of an embodiment of the inspection lamp that includes an attached mirror.

FIG. **10** is an isometric view of the embodiment in FIG. **9** showing a telescoping handle and the light emitted from the LED reflected in the mirror.

DESCRIPTION OF THE INVENTION

FIGS. **1–4** show an embodiment of an inspection lamp **10** in accordance with the invention. This embodiment of inspection lamp **10** includes an LED pen light **12** having an aluminum housing **14**. In this embodiment, shown in FIG. **2**, a rear end of the housing is threaded while the front end includes an aperture for receiving a glass lens capsule **16**. The housing **14** is adapted to enclose the LED pen light's batteries, switch contacts and light source. The pen light **12** uses a blue LED as its light source. The glass lens capsule **16** of the LED extends out through the front end of the housing. An example of a suitable commercially available LED pen light of this type is the STYLUS3 "ICE BLUE" penlight by Streamlight®.

The bottom of the pen light housing **14** has a screw cap **18** that also serves as an ON/OFF switch by pressing the batteries into an electrical connection, either by tightening the screw cap or by pressing a momentary switch at the back of the cap.

A hollow extendible handle **20** is adapted to slidingly engage around the housing **14** of the LED pen light. The top end of the extendible handle is adapted to receive a locking mechanism **24** for locking the handle in a desired position relative to the housing, in effect extending the handle of the inspection lamp **10** to a desired length. In this embodiment, the top end of the handle is threaded and slotted, while the locking mechanism is a threaded collar. When the collar **24** is tightened to the bottom of the threads, it compresses the slotted tip of the handle and presses it against the pen light housing to keep the pen light from sliding within the handle. A stop ring **22** is provided around the pen light housing to prevent the collar from slipping off the front end of the pen light.

In FIG. **1**, the inspection lamp is shown locked in a fully retracted position. FIG. **3** shows the same lamp locked in a fully extended position. FIG. **4** shows the inspection lamp carried as a pen light inside a shirt pocket so as to illustrate the lamp's relative size.

The light from the LED is directed through the rounded tip of the glass lens capsule. Thus, the emitted light beam has its highest light intensity in a narrow beam at the tip of the glass capsule **16**, and the beam diverges as distance from the tip increases.

In FIGS. **5A** and **5B**, an alternative embodiment inspection lamp **26** uses three LEDs **28** inside a lamp housing **30**. The lamp housing **30** is attached to an extendible handle **26** having an upper flexible portion **32** and a lower rigid portion **36** of the inspection lamp. The upper flexible portion **32** includes a hollow cavity and can be adjusted and extended as desired. The upper flexible portion **32** can be folded onto the lower rigid portion **36** to shorten the length of the inspection lamp.

The underside of the lamp housing **34** includes electrical contacts **38** to connect the LEDs **28** to a conductor wire **40**. The wire **40** extends downward from the electrical contact **38** through the upper flexible portion **32** to connect with the batteries **37**. The lower rigid portion **36** includes a removable cap **42**. The removable cap **42** includes a metallic coil for completing the circuit in the typical fashion to power the LEDs **28**.

FIG. **5B** shows a closer view of the lamp housing **30**. The top side of the lamp housing includes a rotatable cover **44**

with an aperture suitable for only one LED for selectively blocking the light from two of the LEDs, so that only the light from one LED is emitted from the inspection lamp at any one time. The lamp housing **30** may contain different LEDs **28** and may also include an incandescent lamp or other suitable source of white light.

For example, the lamp may contain three LEDs, one in each of ultraviolet, blue, and green. Depending on the fluorescent dye being used, the cover can be rotated so that only the appropriate LED is emitted by the inspection lamp. For instance, if a perylene-based fluorescent compound is being used, the ultraviolet LED may be selected. When using a naphthalimide-based fluorescent compound, the blue LED may be selected.

Shown in FIGS. **6**A and **6**B is another embodiment where the pen-size inspection lamp has an extendible handle **46** which is at least part flexible. An upper flexible portion **48** is slidably engaged with the lower rigid portion **50**. The upper flexible portion **48** has an inner diameter greater than the outer diameter of the lower rigid portion **50**. FIG. **6**A shows the inspection lamp in a non-flexed and non-extended position. FIG. **6**B shows the inspection lamp fully extended and partially flexed.

FIGS. **7**A, **7**B, and **7**C show another embodiment of the present invention, in which the inspection lamp has four LEDs **54** attached to a lamp housing **56**. An incandescent lamp or other source of white light may substituted for one of the LEDs. The lamp housing is rotatably attached to an upper portion **58** of an extendible handle **52**. The extendible handle **52** comprises the upper portion **58** and a lower portion **60**. The upper portion **58** is slidably engaged with the lower portion **60**. The outer diameter of the upper portion **58** is less than the inner diameter of the lower portion **60**. The upper portion **58** and lower portion **60** include a hollow cavity as shown in FIGS. **7**A and **7**B. In a preferred embodiment, the hollow cavity of the upper portion **58** contains a power source. In the same embodiment, the power source is an internal power source comprising at least one battery **64**.

The underside of the lamp housing **56** includes a plurality of electrical contacts **62**. The number of electrical contacts **62** located at the underside of the lamp housing **56** corresponds to the number of LEDs and sources of white light **54** attached to the lamp housing **56**. As noted earlier, when working with leak detection dyes, certain LEDs work most efficiently in conjunction with certain fluorescent compounds. In one embodiment, three LEDs, ultraviolet, blue, and green, and one source of white light are attached to the lamp housing. In order to selectively illuminate a single LED or source of white light, the lamp housing **56** is rotated so as to cause the electrical contact of the desired LED or white light to contact the inspection lamp's source of power. For instance, if the green LED is to be emitted by the inspection lamp, the lamp housing **56** is rotated so as to cause the green LED's electrical contact to connect with the power source.

The embodiment of the present invention shown in FIGS. **7**A and **7**B may be extended to illuminate hard-to-reach areas. FIG. **7**B shows the inspection lamp fully extended.

Referring now to FIG. **8**, another embodiment of the present invention is shown in which the inspection lamp **66** includes an extendible handle **67** and a removable LED lamp assembly **72**. In this embodiment, the extendible handle **67** is comprised of a plurality of slidingly engaged cylinders **70** of sequentially reduced diameter to facilitate the handle's ability to extend and contract in a telescoping manner. The telescoping handle **67** may be comprised of any number of cylinders and those cylinders may be of any size or shape. For instance, the circular section cylinders may be replaced with hollow square cylinders. In FIG. **8**, the handle is shown in an extended position.

In one embodiment of the inspection lamp **66** shown in FIG. **8**, there is a battery housing **68** opposite the telescoping handle **67**. The battery housing **68** may include controls **69** for connecting the LED lamp assembly **72** to at least one battery and to have a threaded top (not shown) for releasably engaging a screw cap **71**. The battery housing **68** is configured to accept coin-sized batteries (not shown) to provide electrical power to the LED lamp assembly **72**. The LED lamp assembly **72** is releasably attached to the screw cap **71**. In the depicted embodiment, the LED lamp assembly **72** may be locked in place with a locking mechanism, an example of which is shown in FIG. **8**, numeral **73**. The locking device **73** shown in FIG. **8** is simply shown as an example; those skilled in the art will realize that many arrangements capable of releasably locking the LED lamp assembly **72** to the screw cap **71** could be used.

In a preferred embodiment, the LED lamp assembly **72** includes an LED **74** with a wavelength band having a peak intensity below about 500 nm. It is important to note however, that the LED lamp assemblies **72** are interchangeable, and thus the lamp **66** may be configured with an LED having any wavelength band. Therefore, if it is desirable to utilize an LED of a particular color, the user may simply replace the LED lamp assembly **72** with an LED lamp assembly **72** having the color of choice. For instance, a user using the inspection lamp **66** with a LED lamp assembly **72** having a blue LED may find it desirable to use a LED lamp assembly **72** having a green LED. If so, the user may simply remove the LED lamp assembly **72** having a blue LED and replace it with a LED lamp assembly **72** having a green LED.

In other embodiments, where the LED lamp assembly **72** may include two or more LEDs, it is preferable if at least one LED has a wavelength band with a peak intensity below about 500 nm. In such an embodiment, the controls **69** are adapted to selectively illuminate at least one LED, as desired.

In a preferred embodiment, there is a hinge **75** located between the handle **70** and the housing **68**, as shown in FIG. **8**. In other embodiments, where a hinge is not present, housing **68** is simply attached to the telescoping handle **70**.

It is important to note that the various forms of extendible handles as well as the manner in which the various embodiments are able to emit a single LED or white light and are able to extend and flex is completely interchangeable. For example, the lamp housing **30** and cover **44** used for selectively emitting a single LED as shown in FIGS. **5**A and **5**B may be utilized with the upper **58** and lower **60** cylindrical portions shown in FIGS. **7**A and **7**B.

In other embodiments, aspects of the handle may include alternative means for extending the inspection lamp from a shorter configuration to a longer configuration. Such means may include, for example, a spring and release mechanism for causing the inspection lamp to quickly extend by activating the release of a spring-type mechanism or other device capable of causing the inspection lamp to quickly extend. A means for extending the inspection lamp may also be configured similar in operation to a typical jack knife that is folded in half and locked when not in use. Such a configuration could include a hinge, ball-joint or other suitable element for causing the lamp to be collapsed

approximately in half. A configuration could also include a locking mechanism so that the lamp is locked into place when collapsed or folded, as well as a release mechanism for releasing the lock. The release could be employed with or without a spring-type mechanism.

FIGS. **9** and **10** show an embodiment of the invention in which a mirror assembly **200** is attached to the pen size LED lamp of FIG. **8**. The mirror assembly comprises a mirror **202**, a clip **204** for attaching the mirror to the LED lamp assembly, an arm **206** extending from the clip to the mirror, and a hinge **208** which allows the mirror to be rotated to different reflection angles with respect to the LED assembly. The mirror assembly is clipped onto the LED assembly **172** at or near the battery housing **168**. The clip allows the mirror assembly to be removed from the lamp, and to be attached to the lamp with the arm lying along the lamp for storage or extending in front of the lamp for use in leak detection.

A similar mirror assembly may be attached to others of the various embodiments of the LED lamp. For example, in the embodiment shown in FIGS. **1** to **4**, the mirror assembly may be clipped at or near stop ring **22**. For the embodiment shown in FIGS. **5** and **6**, the mirror assembly may be attached to the flexible portion **32**, **48** of extendible handle **26**, **52** at or near the LED lamp housing **30**. For the embodiment shown in FIG. **7**, the mirror assembly may be attached at or near handle **64** after extension and close to lamp housing **56**.

Adding the mirror assembly to the lamp increases the ability to detect fluorescent material in hard-to-see areas such as around corners or underside surfaces. As shown in FIG. **10**, the user may rotate the mirror so that it reflects the emitted light **210** from the LEDs at an angle set by rotating the mirror on the hinge. The user may then position the mirror to reflect onto a location that cannot be illuminated directly by the LED so that the location may be viewed in the mirror. If fluorescent leak detection material is present, illumination by the LED light reflected off the mirror will produce a fluorescent response and indicate a leak at the location. The mirror will be particularly useful in detecting leaks that occur on the underside or out-of-view portion of air conditioner components, hoses or fittings that cannot be easily accessed for direct observation.

The invention may also be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification, as indicating the scope of the invention.

What is claimed is:

1. An inspection lamp for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent material added to the refrigerant, the inspection lamp comprising an LED pen light having an extendible handle and an LED lamp housing at one end of the handle, the lamp housing containing an LED, said inspection lamp further comprising;

a mirror assembly comprising

a mirror;

a clip for attaching the mirror to the lamp at or near the LED lamp housing; and

an arm extending between the clip and the mirror, said arm having a hinge connection with the mirror for rotating the mirror to different reflection angles with respect to the LED wherein the LED emits light within a wavelength band below about 500 nm.

2. An inspection lamp as in claim **1**, wherein

the handle has an upper flexible portion attached to the lamp housing and a lower portion, wherein the flexible portion may be bent to fit into hard-to-reach areas of air-conditioning systems.

3. An inspection lamp as in claim **2**, wherein the LED emits light within a wavelength band below about 500 nm.

4. An inspection lamp as in claim **1**, further comprising:

the handle having a grip section and telescoping sections adapted to be pulled out to extend the handle and pushed in to retract the handle; and

a battery housing containing a battery, the battery housing being attached at one end thereof to the telescoping section that is furthest from the grip section when the handle is extended.

5. An LED inspection lamp for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent materials added to the refrigerant and lubricating oil, said inspection lamp comprising:

an extendable and retractable handle having a grip section and telescoping sections adapted to be pulled our to extend the handle and pushed in to retract the handle,

a battery housing containing a battery, the battery housing being attached at one end thereof to the telescoping section that is furthest from the grip section when the handle is extended;

an LED lamp assembly connected to the battery housing and containing an LED that emits light within a wavelength band below about 500 nm; and

a mirror assembly having

a mirror,

a clip for attaching the mirror to the battery housing, and

an arm extending between the clip and the mirror, said arm having a hinge connection with the mirror for rotating the mirror to different reflection angles with respect to the LED.

6. A handheld inspection lamp for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent materials added to the refrigerant and lubricating oil, said inspection lamp comprising:

a lamp housing;

at least one LED mounted within the lamp housing and adapted to emit light within a wavelength band below about 500 nm which is adapted to cause the fluorescent materials added to the refrigerant to fluoresce in response to the emitted light;

a handle having an upper flexible portion attached to the lamp housing and a lower portion, the upper flexible portion adapted to be bent to fit into hard-to-reach areas of the air-conditioning system for illuminating leaks in those hard to reach areas by locating the lamp housing in close proximity to the component being inspected; and

an activation button located on the handle and electrically connected to the LED for permitting activation of the LED.

7. A handheld inspection lamp as in claim **6**, wherein the flexible portion may be bent so as to shorten the length of the lamp.

8. A handheld inspection lamp as in claim **6**, further comprising a plurality of LEDs within the lamp housing.

9. A handheld inspection lamp as in claim **8**, wherein the plurality of LEDs comprise at least one LED emitting light within a wavelength band between about 315 nm to about 400 nm.

10. A handheld inspection lamp as in claim **8**, wherein the plurality of LEDs comprise at least one LED emitting light within a wavelength band between about 400 nm to about 480 nm.

11. A handheld inspection lamp as in claim 6, further comprising a mirror movably attached to the handle proximate to the lamp housing.

12. A handheld inspection lamp as in claim 6, wherein the activation button is located on the lower portion of the handle.

13. An inspection lamp as in claim 1, wherein the clip is removably attachable to the side of the lamp housing.

14. An inspection lamp as in claim 13, wherein the LED lamp assembly contains a plurality of LEDs that emits light within a wavelength band below about 500 nm, and wherein the clip is removably attachable to the side of a portion of the handle near the lamp housing.

15. An inspection lamp as in claim 14, wherein the LED lamp assembly further includes at least one source of white light, and wherein the lamp includes a switch to permit activation of the white light source separately from the other LEDs.

16. An inspection lamp for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent material added to the refrigerant, the inspection lamp comprising:

an LED pen light having an extendible handle and an LED lamp housing at one end of the handle, the lamp housing containing at least one LED which emits light within a wavelength band below about 500 nm;

a mirror assembly including

a mirror;

a clip for attaching the mirror to the lamp at or near the LED lamp housing, the clip being removably attachable to the side of the lamp housing; and

an arm extending between the clip and the mirror, said arm having a hinge connection with the mirror for rotating the mirror to different reflection angles with respect to the LED.

17. An inspection lamp as in claim 16, wherein the handle has an upper flexible portion attached to the lamp housing and a lower portion, wherein the flexible portion may be bent to fit into hard-to-reach areas of air-conditioning systems.

18. An inspection lamp as in claim 16, wherein the LED emits light within a wavelength band corresponding to ultraviolet light.

19. Art inspection lamp as in claim 16, wherein the handle includes a grip section and telescoping sections adapted to be pulled out to extend the handle and pushed in to retract the handle, and a battery housing adapted to contain a battery, the battery housing being located adjacent to the LED housing.

20. An inspection lamp as in claim 16, wherein the inspection lamp is part of a kit that includes a dye for introducing into the air conditioning system, the dye adapted to fluoresce when illuminated by light having a wavelength below about 500 nm.

21. An inspection lamp as in claim 16, wherein the LED lamp assembly contains a plurality of LEDs that emits light within a wavelength band below about 500 nm, and wherein the clip is removably attachable to the side of a portion of the handle near the lamp housing.

22. An inspection lamp as in claim 21, wherein the LED lamp assembly further includes at least one source of white light, and wherein the lamp includes a switch to permit activation of the white light source separately from the other LEDs.

23. An inspection lamp kit for detecting refrigerant leaks from air-conditioning systems through illumination of fluorescent material added to the refrigerant, the inspection lamp kit comprising:

an inspection lamp including an LED pen light having an extendible handle and an LED lamp housing at one end of the handle, the lamp housing containing at Least one LED which emits light within a wavelength band below about 500 nm;

a mirror assembly including a mirror, a clip for attaching the mirror to the lamp at or near the LED lamp housing, the clip being removably, attachable to the side of the lamp housing, and an arm extending between the clip and the mirror, said arm having a hinge connection with the mirror for rotating the mirror to different reflection angles with respect to the LED; and

a dye for introducing into the air conditioning system, the dye adapted to fluoresce when illuminated by light having a wavelength below about 500 nm.

* * * * *

Exhibit C

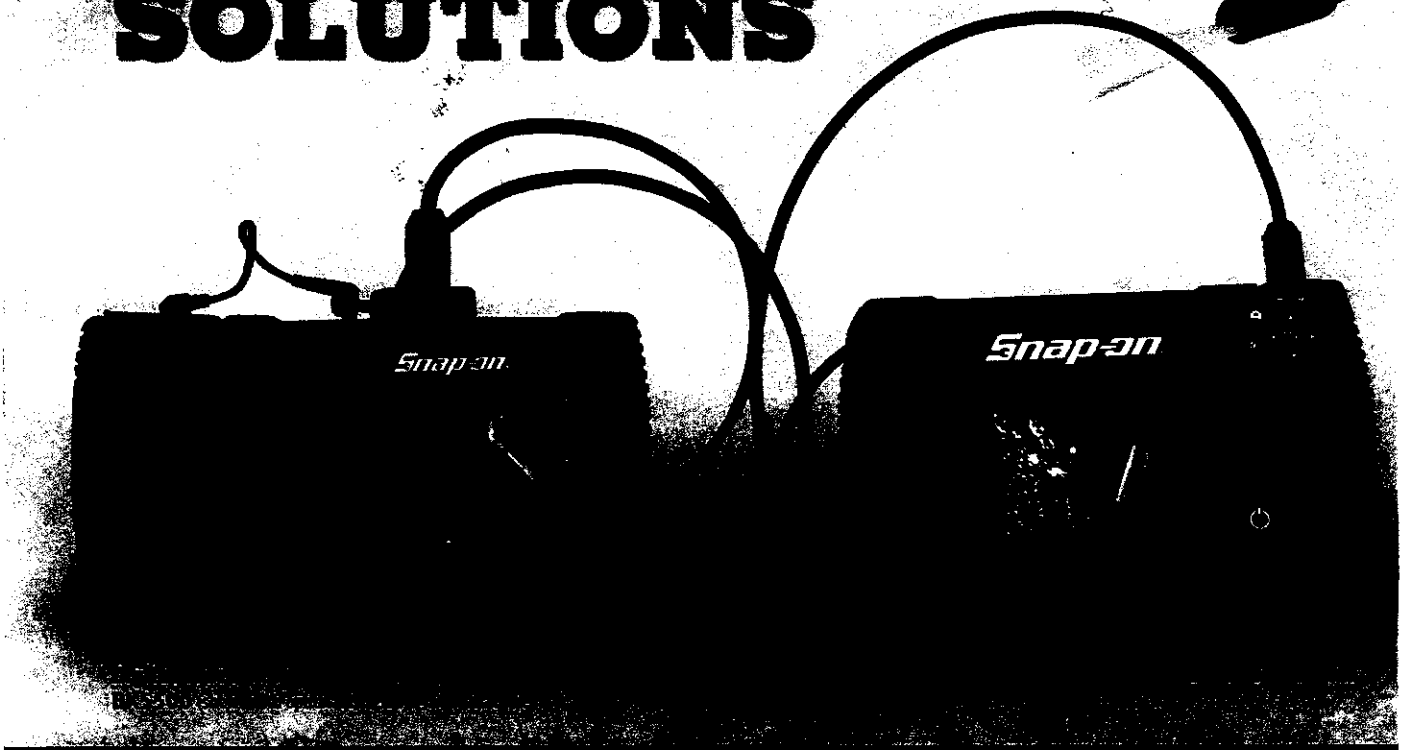
INDUSTRIAL

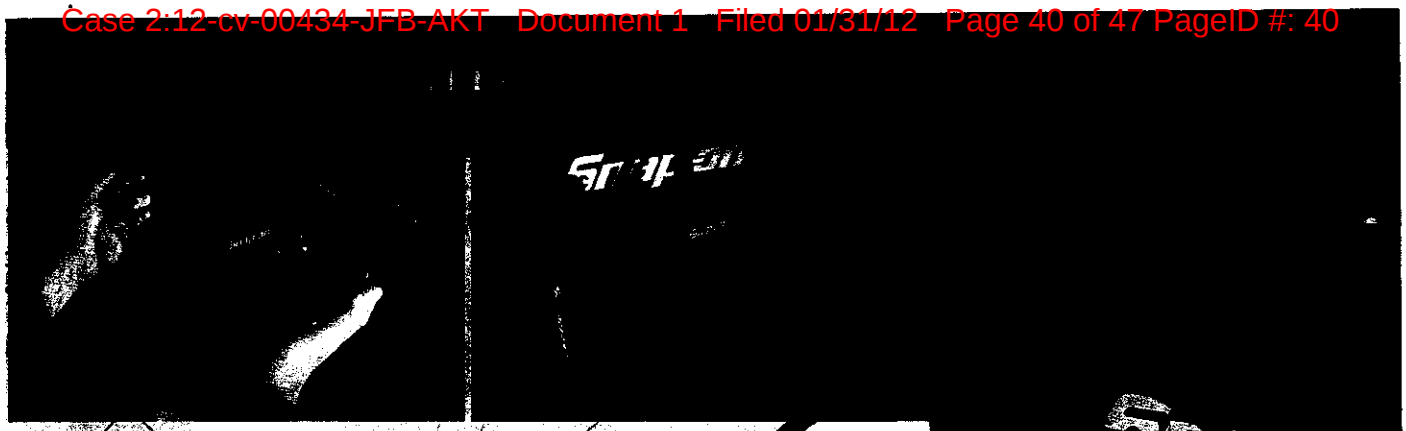
VISUAL INSPECTION SOLUTIONS

Standard Imager Head BK5500-1

Dual Imager Head BK5500-12

Blue Light/UV Imager Head BK5500-10





Visual Inspection Device

- Hook, stand and magnets for hands-free operation
- 8.5mm diameter imager head fits into most spark plug holes
- Quick connect system allows you to change heads for different applications. Additional imagers sold separately
- Fully adjustable LED lighting provides direct light where it is needed
- 36" long flexible shaft
- 0.75" shaft bend radius for great flexibility
- Obedient shaft holds its shape in tight spaces
- 4-AA batteries included
- Durable Tool Housing – for long life
- Waterproof camera head and cable
- Resistant to solvents
- Storage case protects unit
- Waterproof video out jack
- 720 x 480 imager resolution
- 2.45" Color LCD – superior viewing compared to eyepiece borescopes
- Close focus range from 0.5" to 12"

Kit
BK5500

Standard Imager
BK5500-1

Mirror & Magnet
BK5500-2

DVR – Digital Video Recorder

- Capture Video and Still Pictures
- Save images directly to SD card (not included)
- Video and still images can only be viewed once transferred to a computer

BK5500-14 (optional accessory)

WATERPROOF CAMERA HEAD AND CABLE

BK5500 shown with optional BK5500-14

Dual Imager Head
- Ideal for inspecting cylinder walls and valves
- Superior image quality compared to mirrors

BK5500-12

8.5mm Diameter, 36" Long Blue Light/UV Imager
- Ideal for leak detection

BK5500-10

5.5mm Diameter, 36" Imager Head
- Great for Diesel work
- Accepts mirror for 90° viewing
- Mirror threads on for added security

BK5500-13 (Available Q2, 2010)

8.5mm Diameter, 120" Imager Head
- 120" long obedient shaft
- Accepts mirror for 90° viewing

BK5500-9

8.5mm Diameter, 72" Imager Head
- 72" long obedient shaft
- Accepts mirror for 90° viewing

BK5500-7

Ear Bud and Microphone
- Add audio capability to your BK6000

BK6000-11

PRODUCT LINE

● Included in Kit
● Replacement Parts and Accessories

	BK5500 Kit	BK6000 Kit	Accessory for BK5500	Accessory for BK6000
36" Standard Imager – BK5500-1	●	●	●	●
72" Imager – BK5500-7			●	●
120" Imager – BK5500-9			●	●
36" 5.5mm Dia. Imager Head – BK5500-13			●	●
Dual Imager – BK5500-12			●	●
Blue Light/UV Imager – BK5500-10			●	●
DVR Digital Video Recorder – BK5500-14			●	
Ear Bud/Microphone – BK6000-11				●
Mirror/Magnet – BK5500-2	●	●	●	●
BK 6000 Lithium Ion Battery – BK6000-1		●		●
Battery Charger – BK6000-10		●		●
Blow Molded Case – BK5500-6	●		●	
Blow Molded Case – BK6000-6		●		●
Two Year Warranty	●	●		

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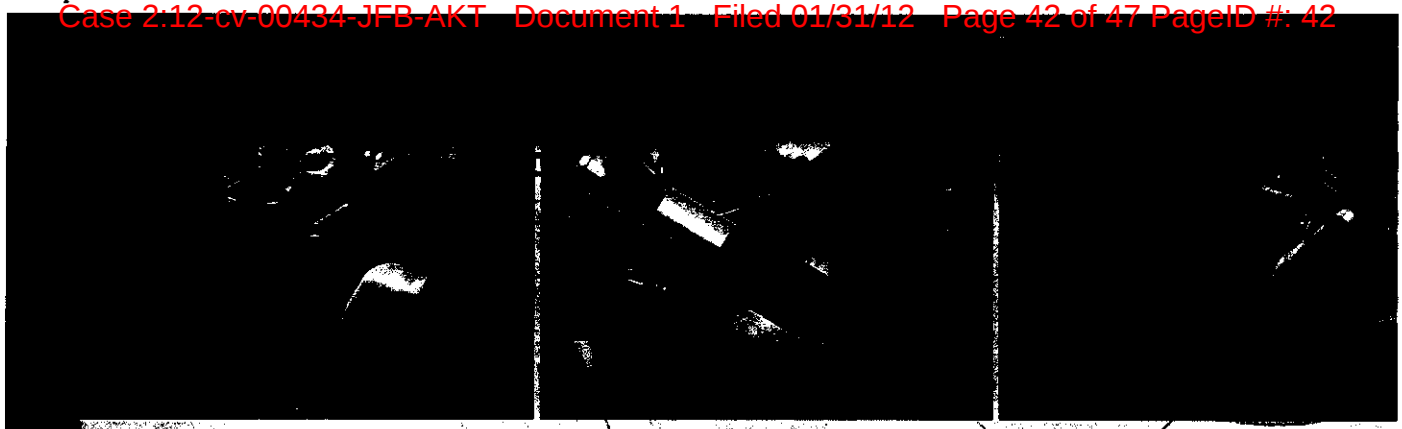
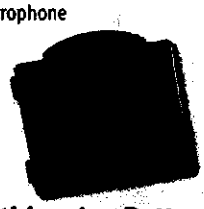
Mixed Sources



RESISTANT TO COMMON AUTOMOTIVE AND INDUSTRIAL CHEMICALS

Visual Inspection Camera

- 720 x 480 imager resolution
- 3.5" LCD resolution of 320 x 240
- 2X digital zoom
- Video-out port for direct analog video out
- Mini-USB connector for uploading images and video to a computer
- Audio input jack for recording comments with an optional microphone
- Rubber over-mold on all contact/gripping areas for added ergonomics and durability
- Stand and hanger allow the user to station device
- Integrated mounting magnets covered by rubber over-mold
- Removable rechargeable Lithium-ion battery pack
- 120VAC plug allows the unit to be used while battery is being charged
- External SD Card access (not included)
- External mini-USB access
- Attachments: 90° Mirror, Magnet
- Complies will the following Safety or Standards associations: FCC, CE, RoHS, WEEE, CCC, PSE and MET (as required)



Lithium Ion Battery
BK6000-1

Kit
BK6000

Standard Imager
BK5500-1

Charger
BK6000-10

Mirror & Magnet
BK5500-2

USB Cable
BK6000-12

S-Hook
BK6000-2

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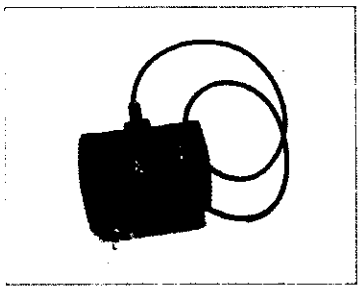
Exhibit D

Commercial Menu

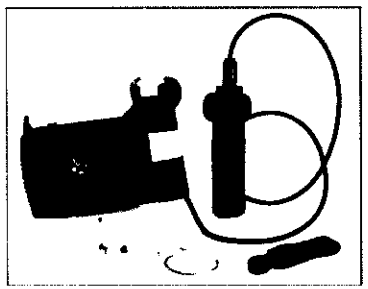
Automotive Technician

Perceptron designed and developed three units and various accessories for the automotive technician.



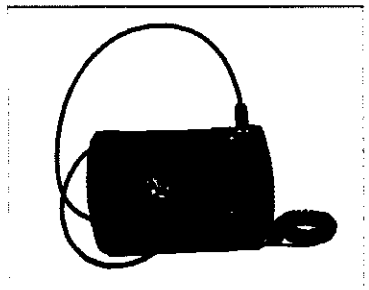
VideoScope Device Features:

- Hook, stand and magnet for hands-free operation
- 8mm diameter imager head fits into most spark plug holes
- Quick connect system allows you to change heads for different applications
- Fully adjustable LED lighting provides direct light where it is needed
- Obedient shaft holds its shape in tight spaces
- 2.5" color LCD display



Wireless VideoScope Features:

- Usable wireless range up to 30' for added maneuverability
- 2.7" color LCD screen
- Four selectable radio frequencies
- Locate screen at comfortable viewing angles



Visual Inspection Camera Features:

- Capture still images at 740 x 480 resolution
- 3.5" color LCD resolution of 320 x 240
- 2X digital zoom
- Mini-USB connector for uploading images and video to computer
- External SD card access
- Removable rechargeable Lithium-ion battery pack
- Control handle disengages to allow greater maneuverability of imager

Click here to see the Visual Inspection Device in action

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Exhibit E

Company Menu

- News
- Careers
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- University of Perceptron
- World Wide Contacts

Perceptron® Announces the Release of its Wireless Video Scope

Plymouth, Michigan, September 27, 2010 - Perceptron, Inc. (NASDAQ: PRCP), a leading provider of visual inspection solutions for Plumbers, Electricians, Technicians and Construction Professionals, today announced the release of its wireless video scope. The wireless video scope represents a significant advancement in Perceptron's visual inspection product line. Designed for the technician, it specifically allows a mechanic to control the imager/probe independently of the screen. The independent movement allows the technician to maintain a comfortable viewing angle while maneuvering the imager into challenging locations and orientations.

"The new level of maneuverability will save the technician time and enable him to perform inspections not previously feasible," said Richard Price, Vice President of Perceptron's Commercial Products Business Unit. "The wireless imager signifies Perceptron's commitment to utilizing innovative technology to solve common problems experienced by our principal end users."

The wireless video scope is the third significant product Perceptron has added to its family of visual inspection solutions for technicians in the last year and a half.

Previously, a UV/Blue Imager was introduced to dramatically aid in the detection of automotive leaks. The custom manufactured LED illuminates fluorescent dyes found in most OEM air conditioning systems. The special UV filter on the camera allows the technician to see the leak without a direct line of sight.

The Dual View Imager has cameras pointing forward and to the side of the imager. The user can change his view by toggling a switch near the base of the imager. The Dual View Imager is the ideal tool for inspecting cylinder walls and valves. The Dual View Imager provides superior illumination and image quality that cannot be matched by scopes that use mirrors.

Both the Blue/UV Imager and the Dual View Imager are compatible with all of Perceptron's automotive video scope products, including the new wireless unit.

For more information on the family of visual inspection products please call Richard Price at (734) 4144606.

Perceptron's technician visual inspection products are distributed exclusively, through Snap-on Tool Company.

About Perceptron®

Perceptron develops, produces, and sells non-contact measurement and inspection solutions for industrial and commercial applications. The products from the Company's Industrial Business Unit (IBU) provide solutions for manufacturing process control as well as sensor and software technologies for non-contact measurement and inspection applications. Automotive and manufacturing companies throughout the world rely on Perceptron's metrology solutions to help them manage their complex manufacturing processes to improve quality, shorten product launch times and reduce overall manufacturing costs. IBU also offers Value Added Services such as training and customer support services. Perceptron's Commercial Products Business Unit (CBU) develops and manufactures a variety of handheld visual inspection devices and add-on accessories for professional tradesmen that are sold to and marketed through strategic partners. Headquartered in Plymouth, Michigan, Perceptron has approximately 230 employees worldwide, with operations in the United States, Germany, France, Spain, Brazil, Japan, Singapore, China and India.

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Scope, Video Inspection, Wireless

•Wireless imager detaches from body to provide added maneuverability
•Transmit and receive images from up to 30 feet away
•Large 2.7" screen for easy viewing
•Updated design and smoother lines make the BK5500W even more compact than the original BK5500
•Same great image quality, same rugged construction
•Uses 3AA batteries in display unit, 3 in transmitter
•Two year warranty
•CE - DE, ES, FR, IT, GB, NL and JP
•Use these optional accessories with the BK5500W:
-BK5500-7 72" Imager
-BK5500-9 120" Imager
-BK5500-10 UV Leak Detector Imager
-BK5500-12 Dual View 90° Imager
-BK5500-13 5.5mm Diesel Imager
-BK5500-14 DVR Attachment

Product Specifications

Stock #	BK5500W
Name	Scope, Video Inspection, Wireless
Price**	$509.95

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